"His Master's Voice" In America



THE PARTY OF THE PARTY.

Foreword

"His Master's Voice" in America is a 90-year photo history of three key pioneering companies in twentieth-century communications: The Victor Talking Machine Company, Radio Corporation of America (RCA) and General Electric Company (GE). Victor introduced musical entertainment into the home, America and the world with the "talking machine," Victrola and disk records. RCA and GE together pioneered telecommunications, radio and broadcasting. RCA introduced the world to television and enabled mankind to advance from wireless messages across the ocean to digital messages across the solar system. The combined contributions of Victor, RCA and GE to national defense, from aircraft parts in World War I to space-based defense for the 21st century, have been significant to the continued security of the United States.

There have been various accounts on the histories of Victor, RCA and GE published over the years, but none have described the historical connection between all three in a single volume. All three companies have carried the world's most famous trademark in electronics — His Master's Voice — from the United States to millions of homes and businesses around the globe. And all three companies have designed and manufactured communications-electronics products at the same facilities in Camden, New Jersey.

Today, GE continues to build upon this legacy of communications pioneering. GE's

Government Communications Systems Department, Camden, NJ is a leader in the design, development and production of sophisticated land, sea, air and space-based communications systems for the United States Government.

This book represents the first chronological account of the people, products and operations of Victor, RCA and GE in Camden, told through a rare collection of photographs, advertisements and published articles which cover the period 1901-1991. Additionally, an opening chapter on the story of the famous trademark "His Master's Voice," and a second chapter on the history of the phonograph industry serve to explain the events that preceded the Victor Talking Machine Company. Highlights of the 67-year history of the Radio Corporation of America are also addressed. These highlights were compiled from a variety of RCA corporate publications and through personal recollections by dozens of former RCA employees. However, all major achievements of RCA are not covered in this documentary. That would be a monumental undertaking requiring several volumes to complete.

This book, the product of over six years of research, does serve to reconstruct a long forgotten archive of the Camden facilities, to recollect major milestones in the history of the Victor Talking Machine Company and the Radio Corporation of America, and to preview the promising years ahead for General Electric Company in Camden, NJ.



The story of "His Master's Voice" in America is the story of communications pioneering, at Camden, New Jersey, of employees who worked and adapted to change, and of two great companies (GE and RCA) whose fortunes saw them begin together, separate, and merge again.

As an RCA employee in Camden from 1958 to 1978, I arrived after the heritage and reputation derived from his Master's Voice had been established. I felt both the pride of my coworkers and the tension of change as Camden became primarily an aerospace and defense oriented location.

More recently, as a GE executive, it has been gratifying to see the employees of Camden adapt, respond to change, and to accept the responsibility for their own future... recognizing that a profitable competitive business is the only real long run security for everyone.

To some extent then, this story can carry greater meaning than just historical interest and perspective. Much of it reflects what made America great in the past, and the need to change to keep it great in the future.

J.D. Rittenhouse Senior Vice-President GE Aerospace

July 1991



RCA Camden is a famous name which is synonymous with innovation and new products in the field of electronics.

While I am a recent Camden arrival, I knew of many RCA Camden accomplishments even before I began my business career. Upon arriving in Camden, I was delighted to find and support Fred Barnum's effort to write this book describing the many fascinating events of RCA history.

This is a story of individual and team accomplishments, of being first, and of rapid change. It is the heritage that provides the basis for what is now GE Camden to face continuing change and to achieve continued future success.

Bell

William G. Gingrich General Manager GE Government Communications Systems July 1991

Acknowledgments

The story you are about to read is, in fact, several stories tied together by a common subject:
Twentieth Century Communications Pioneering from Camden, New Jersey. This is the story of the Victor Talking Machine Company—a pioneer



Fred Barnum

in sound recording and reproduction. This is the story of the Radio Corporation of America—a pioneer in radio, television and communications-electronics. This is also the story of General Electric Company—as a pioneer in radio and television, one of the founding fathers of RCA and a present-day world-class leader in

communications-electronics. Collectively, these three fascinating companies wrote the 90-year history of the Camden plant. Unfortunately, this history was never captured in a single, comprehensive volume. To recreate it was a monumental undertaking. Nevertheless, the challenge was accepted. The project officially began in 1991, but initial work for this publication began nearly seven years earlier by a 27-year-old RCA employee named Fred Barnum.

In 1984, Barnum accepted a job as a Marketing Representative with the RCA Corporation's Government Communications Systems (GCS) group in Camden, NJ. He was inspired by the professional, yet "family," atmosphere throughout the Camden plant and was proud to be an employee of RCA, a corporation whose worldrenown three-letter monogram and "Nipper" logo were associated with the finest products in communications-electronics. The Camden plant was the site of many of the most important developments in the phonograph, radio and television industry. Barnum's fellow employees, many having worked their entire 30 to 40-year careers here, began to intrigue him with their historical anecdotes about the Camden plant and business. Stories were told about the origins of "Nipper" and the famous landmark tower housing the stained-glass renditions of the "His Master's Voice" painting. Accounts of the "Victrola," the first televisions and electron microscope; of Red

Seal records and Caruso recording sessions; of the world's first sonar and microwave radar developments, and of the first radio on the moon were heard. Barnum's interest in the history of the Camden plant grew.

Curiosity took him in search of the "RCA Camden archives." Unfortunately, such a centralized repository no longer existed. Over the years, most official records were either transferred, lost or discarded. Barnum continued his search in the RCA Camden library, where he found a small, but valuable, collection of RCA annual reports, service manuals, and internallypublished periodicals. He next visited the photo laboratory, where catalogued photo negatives dating back only to 1979 were kept. There was, however, a box of old, unidentified negatives which appeared to have been from the 1930's. Talking with co-workers, many having been at RCA Camden since the early 1940's, Barnum learned that much of the material had been sent to RCA's corporate headquarters in New York years ago. A good deal more had recently been scrapped after a basement flood damaged the GCS storage files.

Not allowing this news to dampen his enthusiasm, Barnum turned to the Marketing Department's resident expert, Benjamin D. (Doug) Myers. Myers had an in-depth knowledge of RCA Camden's history and had become the "answer man" for even the most bizarre customer inquiries about RCA and its products. Myers maintained an exhaustive file on RCA's organizational structure, news releases, and Camden products. His material dated back to the 1940's. Barnum spent lunch hours with Myers, strolling around the neighborhood listening to his stories about life there in the 1950's and 1960's. These stories inspired Barnum to begin documenting the plant's history as an after-hours hobby, beginning in 1985. In December of that year, RCA had announced plans to merge with GE. By the following June the merger was complete and Barnum and his fellow RCA colleagues became employees of General Electric Company, one of the foremost communicationselectronics companies in the world. With the merger, GE and RCA had come full circle. GE had formed the Radio Corporation of America in 1919, at the request of the US Navy Department, to keep the fledgling trans-oceanic wireless

communication services in US hands. RCA and GE were together until 1932, when the Government decided to break up what it had helped create 13 years earlier. In 1986, the two were one again after 54 years as two separate companies.

In March 1989, as a committee member for an upcoming Open House for GE Camden employees and their families, Barnum volunteered to produce a historical photo exhibit on the 90year history of the plant. Gathering the few old negatives from the photo lab was a good start, but more was needed. Ed Hutto, a former RCA employee who had produced an in-depth slide presentation on the Victor Talking Machine Company for presentation to company employees in the mid-1970's, was contacted and he gladly sent his slides to Barnum for use in the exhibit. The final product was a collection of 250 captioned and framed photos, which were hung on the walls of the Marketing Department in Building #2-4. The display was a big hit upon its unveiling for the September 1989 Open House. After viewing the exhibit, John Rittenhouse, Senior Vice-President, GE Aerospace, and Tom Corcoran, General Manager, GE Government Communications Systems Department (GCSD), agreed that this collection would make an interesting book. Barnum began to investigate the level of effort required to produce such a book.

Bill Gingrich, succeeding Corcoran as General Manager of GCSD in mid 1990, took an immediate interest in the project and suggested that a survey letter be circulated to current and former employees to determine the level of interest in a book of this nature. Seven thousand letters were distributed and, over the next six months, more than 4,000 enthusiastic responses were received. Gingrich gave the go-ahead on the project in February 1991 and Barnum began the project on a full-time basis the following month.

About this time, Barnum discovered a book in the GE Camden photo lab containing receipts for old photo negatives which had been placed in inactive storage. He took these receipts to the inactive storage area, where he discovered some fifty-odd boxes containing negatives dating back to 1932. The boxes were shipped back to the lab, where he began to sort through them. These negatives, over 100,000 in all, contained images of everything from components to equipment racks; from factory operations to aerial views of the plant. Unfortunately, the log book which described these images was nowhere to be found. On the positive side, all were sequentially numbered in chronological order. Barnum began assigning dates and descriptions to this photo

treasury, utilizing other source references and enlisting current and former Camden employees to help. After three months, a file system was reconstructed to identify and date thousands of them. A significant number of these were reprinted by Tom Del Rossi, GCSD's photographer, and used in this book. This file, however, did not contain human interest subjects, such as those used in *RCA Family* periodicals. A number of current and former employees gladly offered past issues of *RCA Family* from their personal collections, from which many photographs were recopied and used in this book.

Concurrent with photo archive reassembly efforts, Barnum set up a network of information sources to assist in recreating a comprehensive archive on the past 90 years at the Camden plant. Numerous people came forward to contribute to the project: current GE employees; former employees of GE, Westinghouse, and RCA, and many others with no direct association with the Companies. Many provided a valuable piece to the archive through photographs, documents, books, personal correspondence, files, organization charts, and interviews. Many others provided logistics support to produce and distribute the book. These individuals and their associated organizations are hereby acknowledged for their outstanding contributions to the project.

First, to those individuals and their associated organizations outside of GE who provided photographs, documents, and other archival material, sincere thanks are expressed: Phyllis Smith and the David Sarnoff Research Center. Subsidiary of SRI International, Princeton, NJ; Ann Horsey, Gerry Graf and the Delaware State Museums, Dover, DE; John Anderson and the Hall of History Foundation, Schenectady, NY; Toni Gutwein and the Camden County Historical Society, Camden, NJ; Tom Corcoran and the Cooper's Ferry Development Association, Camden, NJ; John Sullivan and the Ballinger Company, Philadelphia, PA; Gene Fricks and Stone & Webster Engineering Corporation, Cherry Hill, NJ; Ruth Edge and EMI Music Archives, Hayes, Middlesex, England; Neil Maken and Yesterday Once Again, Fountain Valley, CA; Allen Koenigsberg and Allen Koenigsberg Antique Phonographs, Brooklyn, NY; Peter Martland and Cambridge University, England; Oliver Berliner and the Berliner family, John Dowden, Glen Cove, NY and the National Aeronautics and Space Administration (NASA).

Next, appreciation is expressed to the RCA pioneers and former employees who provided critical missing pieces on the RCA Camden story with photographs, documents, and personal accounts on their pioneering efforts at Camden: Ted Smith, Loren Jones, Felix Cone, George Prestwich, Stan Cochran, Joe Beezer, Howard Rosenthal, Barton Kreuzer, Tony Lind, John Link, Nate Zausner, Bob Bitting, Dr. Ernest Linder, David Serfling, Don Parker, Hugh Montgomery, Nick Gambino, Don Hoger, Dino D'Andrea, T.T.N. Bucher, Bill Eisenberg, Hank Sawyer, Al Sproul, Jackie Flechtner, Joe Sangrey, John Barbour, Bruno Melchionni, Pat Kennedy, Lloyd Martinson, Dana Pratt, Tom Flythe, Ed Hutto, Tony Maugeri, Sam Holt, William J. Regan, Doug Myers, Andy Inglis, Lytle Hoover, Carmen Mazzuca, Tony Ricketti and Dan Tannenbaum.

Gratitude is also expressed to the people who assisted in distribution of the survey to generate interest in this project and to their respective organizations: Ray MacWilliams, GE Government Services, Cherry Hill, NJ; Linda Dulye and Bobbie Murokami, GE Government Electronic Systems Division, Moorestown, NJ; Lynn Mazer, GE Astro-Space, Princeton, NJ; Herb Motley, GE Automated Systems, Burlington, MA; Ken Leinweber, GE Military and Data Systems Operations, Valley Forge, PA; Carmen Mazzuca, Thomson Consumer Electronics, Deptford, NJ; Phyllis Smith, David Sarnoff Research Center, Princeton, NJ; Brenda Myers-Camarata, Thomson Consumer Electronics, Indianapolis, IN; Tom Croasmun, Harris Corporation, Findlay OH; the Ex-RCA'ers Lunch Clubs in New Jersey and Florida; the RCA Retirement Club in New York; John Whitacre and the Michigan Antique Phonograph Society, Lansing, MI.

The efforts of Carolyn Spillner and Mary Lou Nichols, GE Client Business Services, Ft. Myers, FL, who provided great financial coordination support; George R. Powers and Peter Jeffrey, GE Corporate Legal Staff; and James R. Harman, GE Corporate Advertising, who provided valuable assistance in reviewing the manuscript, are also acknowledged.

A sincere thanks also to the employees of GE GCSD who provided a wide range of support functions, from contributing archival material to lending administrative support: Ron McHugh, Valerie Deorio, Cathy Stewart, Dee Pluese, Denise DiAngelo, Brian Riley, Gloria Quinlan, Clancy Smith, Sam Pietrofitta, Paul Muraco, Marty Watson, Edy Mozzi, Tom Pote, Rita Romantini, Tom Meehan, Joan Bruce, Bob Renegar, Dick Foley, Denyse Le Fever, Dennis Basara, Gordon Granert, Marty Karch, John

Tchou, Jim Newman, Jim Carroll, Joanne Williams, Pete Piotti, Don Herzog, Tom Padden, Joe Springer, Grace Desimine, Jim Fayer, Maurice Timken, Tony Rodrigues, Pete Greene, Jim Stewart, Janet Kochersperger, Pat Taylor, Esther Perozzi, Kass Miller, Doris Peterson, Frank Hazel, Jan Conahan, Phyllis Layman, Mike Rielly, Bill Goldy, Ernie Jackson, John Shannon, Gloria Meyers, Harry Wilson, Tom Shapiro, Pat Cintione, Mary Ann Brunelli, R. F. Smith, Ed Nossen, Chuck Shelton, Larry Peterson, George Chase, Buck Estell, Marc Meiches, Jamie Ritter, Glenn Ross, Larry Cochran, Art Cassidy, Joan Houser, Floss Fiorentino, Howard Arndt, Neal Murray, Jean Fine, Maxine Lawrence, and especially the core project team of Tom Del Rossi, Maryellen Pignataro, Dick Van Meter, Tom Wajda, Bob O'Neill, Jim Di Pietro, Bob Ekey, Carol DeRooy and Vilma Gambino. Appreciation is also expressed to other contributors to this project who were inadvertently not listed above.

A special thanks to Bill Gingrich, General Manager, GE GCSD, for his appreciation of the historical significance of the Camden plant and his sponsorship of this worthwhile project.

In addition to those just mentioned, a number of authors whose works were used as references are acknowledged. They are listed separately in the bibliography.

Thanks are also gratefully extended to Fred Barnum's spouse Marian. Over the past six months, she single-handedly raised their two-year-old twins, Kimberly and April, gave birth to their third child, Frederick IV, and still found the time to proofread the manuscript and provide editing assistance. Her patience and constant support allowed her spouse to complete the tremendous tasks of researching, compiling, writing, editing, advertising, and distributing this book in a very short time.

Finally and most importantly, a special thanks to Fred Barnum, whose dedication, creativity and persistence brought this book from concept to reality.

This documentary is only as complete as sources and time allowed. Any omissions, deletions or inaccuracies are strictly unintentional. All source references were unclassified.

The words and images contained in this volume are meant to invoke feelings of pride, nostalgia, and motivation in the hearts of current and former employees of GE and RCA in Camden, NJ. It is meant to be a testimonial to the past as well as an inspiration for the future. If, after reading it, you feel the same way, then the time and efforts over the last six years were well spent.

This book is dedicated to the men and women of the Victor Talking Machine Company, Radio Corporation of America and General Electric Company, whose talent, vision, and dedication brought "His Master's Voice" from Camden, New Jersey to the world.

Contents

Chapter 1: The Story of Nipper and "His Master's Voice"
Chapter 2: The Early Years: Phonographs to Gramophones (1877-1900)
Chapter 3: The Victor Talking Machine Company (1901-1929)
Chapter 4: The Radio Corporation of America: The First Decade (1919-1929)
Chapter 5: RCA Victor: From Radio to Television (1930-1939)
Chapter 6: In Service to the Nation (1940-1945)
Chapter 7: The Post-War Era: Television to Defense Electronics (1945-1955)
Chapter 8: The Age of Computers and Space Exploration (1956-1967)
Chapter 9: Diversification, Realignment and Return to Core Strengths (1968-1985) 323
Chapter 10: GE and RCA: Reunited and Refocused for the Future
Bibliography



Chapter 1

The Story of Nipper and "His Master's Voice"

"Nipper was really a very clever little dog – of course one is always inclined to think one's own dog cleverer than those belonging to other people – but he was most original."

- Francis Barraud

hese were the words of the English painter Francis Barraud who created the world famous picture *His Master's Voice*. Nipper, his fox terrier, was the inspiration. Francis Barraud was, in fact, the dog's second master. As he explained:

"Nipper . . . belonged to my brother Mark, who was a scenic artist in Bristol for many years. He never left my brother's heels; when Mark took his 'call' for a transformation scene, Nipper always followed him on to the stage. When my brother died, Nipper attached himself to me, and I had him for many years."

Mark Henry Barraud acquired the three-month old pup in 1884. Mark died in 1887, and Francis became the dog's second and last owner. Nipper died in 1895 and was buried in a garden at Kingston-upon-Thames, England.

It is difficult to pinpoint the exact date of the original painting. Francis Barraud stated that "It was originally designed and painted by me some time prior to the year 1899 . . ." He filed an Application for Memorandum of Assignment of Copyright of his picture of dog looking at and listening to a phonograph on February 11, 1899. It is reasonable to assume he had just recently completed the painting, probably between December 1898 and January 1899.

What gave Barraud the idea to create his famous work? In his own words it is best explained:

"It is difficult to say how the idea came to me beyond the fact that it suddenly occurred to me that to have my dog listening to the phonograph, with an intelligent and rather puzzled expression, and call it *His Master's Voice* would make an excellent subject. We had a phonograph and I often noticed how puzzled he was to make out where the voice came from. It

Photograph of the "real Nipper" (1884 to 1895). Courtesy: EMI Music Archives.

1) Original version of "His Master's Voice" with Edison-type cylinder phonograph. Courtesy: EMI Music Archives.

2) Modified version of "His Master's Voice" with Berliner Disk Gramophone repainted according to instructions from the Gramophone Co. Ltd. of London, who paid Francis Barraud £50 for the painting and £50 for the copyright on October 17, 1899. Courtesy: EMI Music Archives.







was certainly the happiest thought I ever had."
The original painting depicted Nipper with a
Phonograph, which was Thomas Edison's name
for his sound reproduction machine that played
wax cylinders. Specifically, it was an Edison
'Commercial' Phonograph which was marketed in
Britain by the Edison Bell Company.

Barraud showed his painting to several publishers in an attempt to sell it, but received only a few small offers. He then decided to improve it by substituting a brass horn for the plain black one. A friend suggested that Barraud visit the Maiden Lane offices of the Gramophone Company Ltd. of London to request a loan of a brass horn to be used as a model. Armed with a photograph of his portrait, he paid them a visit in May 1899. There Barraud's work was shown to Mr. William Barry Owen, the manager, who formed the company in 1898 to exploit the patents of the Berliner Gramophone Company of Philadelphia, PA.

Owen took an interest in Nipper and agreed to purchase the painting after the artist painted out the Edison cylinder Phonograph and painted in a Berliner Disk Gramophone. On September 15, 1899 Owen paid Barraud £50 for the painting and £50 for the transfer of the copyright.

The Gramophone Company Ltd. began using Nipper in its advertising literature in 1899. In May of that year Emile Berliner, inventor of the Disk Gramophone, traveled to London to visit the Gramophone Company and returned to the United States with a copy of the trademark. On May 26 he applied to the US Patent Office in Washington DC. The "Trademark for Gramophones" (No. 34,890) was issued on July 10, 1900, marking the official arrival of "His Master's Voice" in America.

The Victor Talking Machine Company of Camden, NJ acquired the US rights to "His Master's Voice" from Emile Berliner in 1901, and Nipper was launched to worldwide fame on Victor Talking Machines, Victrolas, and records.

Francis Barraud is known to have made 24 replicas of his original painting. Five of these went to directors of the Victor Talking Machine Company: Eldridge Johnson (April 1913), Albert Atkinson, Walter Staats and Albert Middleton (February 1914) and Emile Berliner (June 1914). Victor also commissioned Barraud to paint 12 more, which were intended for certain clients of the company. All 17 copies for Victor were done for a fee of £35 each.

In December 1919, the Gramophone Company and the Victor Talking Machine Company agreed jointly to pay Barraud a £250

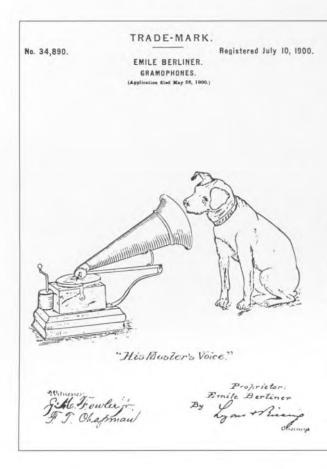


per year annuity. This amount was increased to £350 in March 1924.

Barraud died on August 29, 1924, at the age of 68 at his home in St. John's Wood, London. Several artists were called upon by Gramophone and Victor to make replicas. An unknown quantity was produced by English painter A. Edmund Dyer for Victor. One was produced by H.M. Paget, also English, in 1925. A third English painter, C.H. Thompson, produced 12 more between 1926 and 1930. In 1929, four other replicas were produced, two each by a Dutch and Danish artist. The names of both painters remain unknown today. These were all the authorized replicas of Barraud's painting.

In 1931, the Gramophone Company, Ltd. and the Columbia Graphophone Company Ltd.,

3) Francis Barraud (1856-1924) making replicas of his painting at Hayes, Middlesex, England in 1922, for the Victor Talking Machine Company of Camden, NJ. Courtesy: Delaware State Museums.



UNITED STATES PATENT OFFICE

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

TRADE-MARK FOR GRAMOPHONES.

STATEMENT and DECLARATION of Trede-Mark No. 34,890, registered July 10, 1900. Application filed May 28, 1900.

To all whom it may concern:
Beit known that I, EMILE BERLINER, a citi-

Beit known that I, EMILE BERLINER, a citizen of the United States, residing at No. 1717
P street northwest, Washington, District of
Columbia, and doing business at No. 1023
Twelfth street northwest, in said city, have
adopted for my use a Trade-Mark for SoundReproducing Machines, their Appurtenances,
and Records, of which the following is a full,
to clear, and exact specification.

Ny trade-mark consists of the picture of a
dog in the act of listening to a sound-reproducing machine. This picture has been generally arranged as represented in the accompanying facsimile, which shows a sound-reproducing machine and a dog apparently listening to the sounds issuing from the horn of
said machine. Underneath said picture appear the words "His Master's Voice;" but
this is unimportant and may be omitted, since

the essential feature of my trade-mark is the picture of the dog listening to the sound-re-producing machine.

This trade-mark I have used continuously

in my business since May 24, 1900.

The class of merchandise to which this trademark is appropriated is sound-reproducing machinery and the appurtenances therein, such as sound-records and the like. The particular description of goods comprised in said 30 class upon which I use the trade-mark is grainophones.

I may apply my trade-mark to the boxes in-closing the driving mechanism for the sound-reproducing machinery or to the back or front 35 of the record-tablets.

EMILE BERLINER.

Witnesses: F. T. CHAPMAN, E. C. MARSHALL

DECLARATION.

City of Washington, District of Columbia, as:
EMILE BERLINER, being duly sworn deposes and says that he is the applicant named in the foregoing statement; that he verily believes the foregoing statement is true; that he has the trade-mark sought to be registered. City of Washington, District of Columbia, as:
EMILE BERLINER, being duly sworn deposes
and says that he is the applicant named in the
foregoing statement; that he verily believes
the foregoing statement is true; that he has
at this time a right to the use of the trademark therein described; that no other porson, firm or corporation has the right to such
use, either in the identical form or in any
such near resemblance thereto as might be
calculated to deceive; that it is used by him
commerce between the United States and

EMILE BERLINER.

Sworn to and subscribed before me this twenty-fifth day of May, 1900.

[L. S.] EDWIN S. CLARKSON, Notary Public, D. C.

merged to form Electric and Musical Industries, Inc. The company name was officially changed to EMI Ltd. in 1971. The original painting resides today at EMI, in London, England.

Following the purchase of Victor by the Radio Corporation of America in 1929, "RCA Victor" and Nipper were introduced together on RCA commercial electronics products and records. For the next 57 years, "His Master's Voice" appeared on millions of RCA consumer electronics products.

The RCA Corporation merged with General Electric Company in June 1986 and GE now owns the US rights to all RCA trademarks and the "His Master's Voice" trademark. In 1986, RCA Records was sold to Bertelsmann AG and the RCA and GE Consumer Electronics businesses were sold to Thomson SA. Today, under licensing agreements with GE, the RCA and "His Master's Voice" trademarks are used by both Bertelsmann AG and Thomson Consumer Electronics, Inc. GE Appliances has also introduced the RCA block-style logo and Nipper (minus the gramophone) on its products.

Ninety years after its arrival in Camden, NJ, "His Master's Voice" has become the world's most recognized trademark in communications, electronics, and entertainment.



- 1) "His Master's Voice" comes to America. This US trademark (No. 34,890) was granted to Emile Berliner on July 10, 1900 for the use of Nipper as the trademark for his Gramophones.
- Trademark of the Victor Talking Machine Company, 1911.
- 3) A combination of "His Master's Voice" and the Radio Corporation of America's monogram became the trademark of the RCA-Victor Company, Inc. in 1933. This version was introduced in 1935, when the Camden operation became the RCA Manufacturing Company, Inc.
- 4) RCA Victor trademark as the "guardian of quality" in radio, television and recorded music, 1953.
- 5) A modernized Nipper was introduced by RCA in 1978. Coupled with an updated RCA trademark, this combination was used extensively by RCA Records, Broadcast Systems and Consumer Electronics. Today, under licensing agreements with GE, these trademarks are used by both Bertelsmann AG and Thomson Consumer Electronics, Inc.









Chapter 2

The Early Years: Phonographs to Gramophones (1877-1900)

"The foil was put on and I then shouted 'Mary had a little lamb' and so on. I adjusted the reproducer and the machine reproduced it perfectly. I was never so taken back in my life. Everybody was astonished. I was always afraid of things that worked the first time."

— Thomas A. Edison Describing the first test of his Tinfoil Phonograph, 1877

is Master's Voice" arrived in America in 1900 but the sound reproduction industry was born over 40 years earlier. The history begins with a French scientist named Leon Scott de Martinville who, in 1857, designed the "phonautograph" which traced the wave form of sound on a cylinder.

Twenty years later, a young French poet, Charles Cros, submitted a packet to the French Academy of Sciences which contained details of a scheme for reproducing the traces captured by Scott. Cros' idea was submitted to the Academy in April 1877 with instructions that it not be opened until December. The Academy complied and the Cros plan was unfortunately revealed too late to gain him the honor of inventing the phonograph. By August, a 30-year-old American demonstrated a machine that could reproduce as well as record sound.

The Phonograph

Thomas Alva Edison invented the Tinfoil Phonograph at his Menlo Park, NJ laboratory in August 1877. He had gotten the idea when, as a young telegraph operator, he built a device which allowed him to record messages by punching dots and dashes on a tape. He would later re-run the tape to transcribe those messages. When played at high speed the tape produced, according to Edison, "A light, musical, rhythmic sound resembling human talk heard indistinctly." He reasoned that vibrations of the human voice could also indent a tape and devised a machine similar to Scott's, except that the cylinder had helical grooves and was covered by tinfoil. The voice was recorded by speaking into a flexible diaphragm attached to a metal pin. The vibrations caused the pin to indent the foil as the cylinder was rotated. The recording was then reproduced by playing it

Thomas A. Edison (1847-1931) and his improved Tinfoil Phonograph, Washington, DC, April 18, 1878. against a "sound box."

On December 24, 1877, Edison filed details of his latest invention at the US Patent Office. The patent (US No. 200,521), issued on February 19, 1878, was indexed under the title *Phonograph or Speaking Machine*. This marked the official birth of recorded sound and its subsequent massive industry. That same year, the Edison Speaking Phonograph Company was organized to exploit the instrument's novelty appeal.

Birth of the General Electric Company

Edison, however, turned his attention to another project by late 1878 which he considered far more important: perfection of the incandescent or electric light. His goal was to light New York and London and, by 1882, low voltage DC generating stations were operating at Pearle Street and the Holborn Viaduct. The Edison Machine Works had started the first central generating stations to light these two cities.

The Machine Works was moved to Schenectady, NY in 1886, where it was consolidated in 1889 with Edison's three other companies (Edison Electric Light Company, Edison Lamp Company and Bergmann & Company) to form the Edison General Electric Company. In 1892, the Edison General Electric Company merged with the Thomson-Houston Company of Lynn Massachusetts and the General Electric Company was born.

The Rivalry Begins: The Bell Graphophone

While Edison's attention shifted away from the phonograph, his 1877 tinfoil machine sparked intense rivalry.

Chichester Bell, working with Charles Sumner Tainter at the Volta Laboratory in Washington DC developed and, on May 4, 1886, patented an improved recording process utilizing wax instead of tinfoil cylinders. It was called the "Graphophone" and it became direct competition to Edison's "Phonograph." Funding for the Graphophone came from Alexander Graham Bell, who invented the telephone a year before. Edison countered with a perfected wax-cylinder version of his own Phonograph.

The Bell and Tainter process was marketed by the American Graphophone Company, established in Philadelphia in June 1887. Soon after, exclusive rental and sales rights were acquired by Jesse H. Lippencott, who also purchased the Edison Speaking Phonograph Company. On July 14, 1888, Lippencott formed the North American Phonograph Company as the sole licensee for both the Bell Graphophone and Edison Phonograph. No machines were sold but Lippencott licensed local companies to maintain those machines out on rental. Among those was the Columbia Phonograph Company, organized in 1889 with exclusive rights in Delaware, Maryland and the District of Columbia.

Following Lippencott's death in 1891, his North American Phonograph Company collapsed. To regain control of his patents, Edison threw the company into bankruptcy, and later established his own sales organization. Edison's first machines sold for \$150.

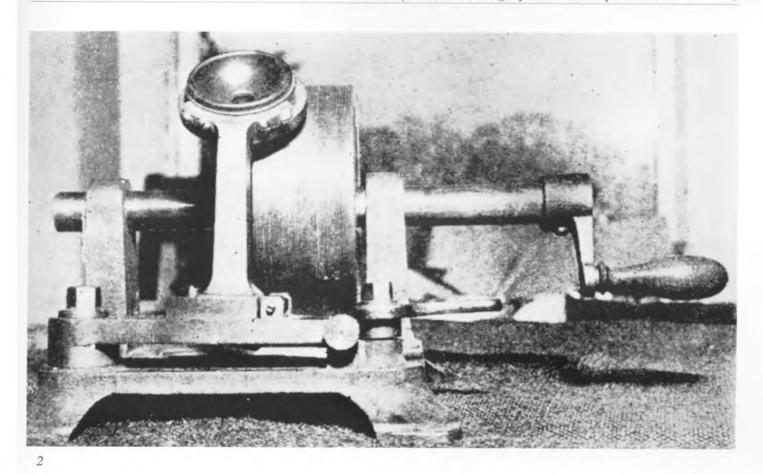
The Berliner Gramophone

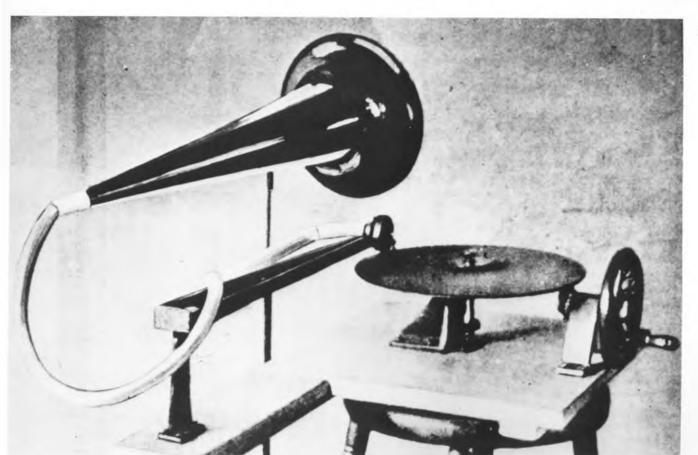
While the North American Phonograph Company launched its cylinder-type machine, another young inventor appeared on the scene with a radically different idea. Emile Berliner, a German-born telephone expert of Washington, DC, introduced a machine which featured the world's first commercially available flat disk.

On November 8, 1887, Berliner was issued the US patent (No. 372,786) for a disk playing "Gramophone." Berliner stated his invention to be an improvement of the "phonautograph of Leon

- 1) Thomas Edison on July 16, 1888, after laboring on continued improvements to the wax cylinder Phonograph at his new laboratory in West Orange, NJ. Edison moved his residence and laboratory from Menlo Park to West Orange in 1887. Courtesy: Hall of History Foundation.
- 2) The original Bell Graphophone, brought to the Smithsonian Institution in 1881.
- 3) The Berliner Gramophone, which was demonstrated at the Franklin Institute in Philadelphia, PA on May 16, 1888.









4 Sheets-She 3 (No Model.) E. BERLINER. GRAMOPHONE. Patented Feb. 19 1895. No. 534.543. 26 Inventor. Boy Chapman Emile Berliner, By Jouet &

Scott", but one of his patent drawings also showed a sheet of recording material mounted on a cylindrical drum. This suggests that Berliner also drew upon Edison's cylinder process. Berliner's entry of the disk into the sound recording industry resulted in the eventual demise of both the Edison and Tainter cylinders.

Berliner's system, moreover, included a manufacturing technique which provided a master record from which duplicate copies could be made. This could not be accomplished with cylinders.

The flat disk had a groove that not only vibrated the phonograph needle to reproduce sound, but piloted the sound box and horn across the record. The record vibrated the needle laterally by means of modulations in the walls of the grooves, as opposed to the "hill and dale" method used by his rivals.

In 1893, Berliner formed the US Gramophone Company in Washington, DC to which he assigned his patents for his original hand-powered Gramophone. His instruments, made by outside vendors, were used in exhibitions and demonstrations as a scientific novelty. These initial efforts proved to be commercially unsuccessful.

On October 8, 1895, the Berliner Gramophone Company of Philadelphia was established as a manufacturing unit. Operations were set up at 1026 Filbert Street and 404 South 10th Street to build the Gramophones. Berliner's Washington DC unit continued to handle the complex processing of disk matrices.

By 1896, Berliner's Gramophone was considered a milestone achievement, but the machine required improvements. Being hand-propelled, the Gramophone could not maintain constant pitch during playback. Berliner needed a spring motor to make his product a commercial success. A young machinist in Camden, NJ provided the solution. His name was Eldridge Reeves Johnson.

- 1) Emile Berliner, inventor of the disk playing Gramophone, examining a matrix used to press disk records, early 1920's. Courtesy: Oliver Berliner.
- 2) The improved Berliner Gramophone was patented on February 19, 1895. One year later this model was brought from Philadelphia to Camden in search of a spring motor.
- 3) The May 16, 1896 issue of Scientific American featured the Berliner Gramophone on the cover. Courtesy: Neil Maken.

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.-No. 20. Established 1845.





Chapter 3

The Victor Talking Machine Company (1901-1929)

"The Victor Company is now in possession of many patents and secret processes, but our greatest secret process is this — WE SEEK TO IMPROVE EVERYTHING WE DO EVERY DAY."

- Eldridge R. Johnson, 1919

he story of twentieth century communications pioneering in Camden, New Jersey begins with Eldridge Reeves Johnson, who introduced "His Master's Voice" to America and the Victor Talking Machine Company to the world.

Johnson was born on February 6, 1867 in Wilmington, Delaware. The son of Asa Johnson and Caroline Reeves Johnson, Eldridge moved to Kent County, Delaware at the age of two upon his mother's death. He remained there with his mother's aunt until 1878.

His father had, by this time, remarried and brought Eldridge to Dover, Delaware. Here he attended school until the age of fifteen, graduating from the Dover Academy in 1882. The following year, Johnson moved to Philadelphia, where he stayed with his stepmother's sister and took an apprenticeship with the firm of J. Lodge and Son, 103 South Hudson Street (later called Orianna Street).

For the next four years Johnson spent sixty-hour work weeks repairing heavy machines used for printing and wire stitching. His apprenticeship ended in 1886 and he was offered a position at the Standard Machine Shop at 108 N. Front Street in Camden, New Jersey. Johnson was hired by the shop foreman, Belford G. Royal.

The Standard Machine Shop, a small 20 x 40-foot building behind the Collings Carriage Company, was purchased in 1886 by Captain Andrew Scull. He started the business for his son John, who recently graduated as a mechanical engineer from Lehigh University. John Scull was a talented young man. He was working on the design of an automatic book binding machine when, in 1888, he died suddenly. Captain Scull, having no interest in the repair business himself, offered Johnson the position of foreman and asked him to complete the automatic book binding

Eldridge Reeves Johnson, age 33, on the eve of the birth of the Victor Talking Machine Company (1900). machine. By this time, the business' name was changed to the Scull Machine Shop. Johnson completed the project in 1890, at which time he resigned and headed west to explore new horizons. He spent the next year in the state of Washington, finding ample employment opportunities with good salaries. However, he saw little opportunity for promotion and returned to the Delaware Valley in 1891.

Upon his return, Johnson found Captain Scull in financial turmoil. Unable to market the book binding machine due to excessive manufacturing costs, Scull asked Johnson to return as foreman of the shop. He offered Johnson half of all future profits. Johnson accepted and spent the next two years on pauper's wages re-designing and producing an improved wire stitching machine for book binding. On April 25, 1893, he was issued the US patent for his machine (No. 496,314) and he set up the New Jersey Wire Stitching Machine Company to market it.

But the work was very difficult and Johnson paid his dues to achieve success. As he later stated: "The sacrifices that I made in the early stages of my career for the purpose of being my own boss were more than I would care to be forced to repeat . . . It was a close race with failure even for me — neck and neck for a long time. I did not win by superior speed; it was a question of endurance."

In October 1894, Johnson purchased his partner's interest in the firm of Scull and Johnson, Manufacturing Machinists and renamed the business Eldridge R. Johnson Manufacturing Company. He hired Belford G. Royal, who was Scull's foreman when Johnson began there. Johnson concentrated on manufacturing experimental models of new inventions.

Johnson's first encounter with the Gramophone happened in February 1896, when Belford Royal brought a Mr. Henry Whitaker to the shop. In his hands was a Berliner Gramophone, for which he asked Johnson to design a spring motor. Johnson's design was rejected, but he became fascinated with a machine that talked. In later years he reflected: "The little instrument was badly designed. It sounded like a partially educated parrot with a sore throat and a cold in the head, but the little wheezy instrument caught my attention and held it fast and hard. I became interested in it as I had never been interested in anything before."

Johnson immediately began experimenting with his own designs and within a few months

built both an acceptable spring motor and an improved sound box. He received his first order from Berliner on August 10, 1896, for a pilot run of 100 units. Over the next two years he built motors, sound boxes and metal parts, purchased the horns and cabinets, assembled the components and delivered completed instruments under subcontract to Berliner.

The Johnson Recording Process

In 1896, Johnson began experimenting with an improved process of recording which became an important factor in the later success of the Victor Talking Machine Company. This process involved improved recordings on flat wax-like 1) Johnson's first patent (US No. 496,314) for a redesigned book binding machine was received April 25, 1893. The New Jersey Wire Stitching Company was set up to market it.

(No Model.) 3 Sheets-Sheet 1. E. R. JOHNSON. WIRE STITCHING MACHINE. No. 496,314. Patented Apr. 25, 1893.



- 2
- 2) The former Scull Machine Shop, located in the rear of the Collings Carriage Company, 108 N. Front Street, Camden, NJ. Eldridge Johnson accepted a job here in 1886 at the age of nineteen. In 1894 he bought out Scull's interest in the shop and set up under his own name. This was the birthplace of the Victor Talking Machine Company.
- 3) The Collings Carriage Company, 108 N. Front Street, Camden, NJ, late 1890's. The roof of Johnson's Machine Shop (two chimneys) is visible behind the carriage shop. (Looking southeast from Cooper Street. Note the familiar "soup can" water towers of the Campbell Soup Company in the background).



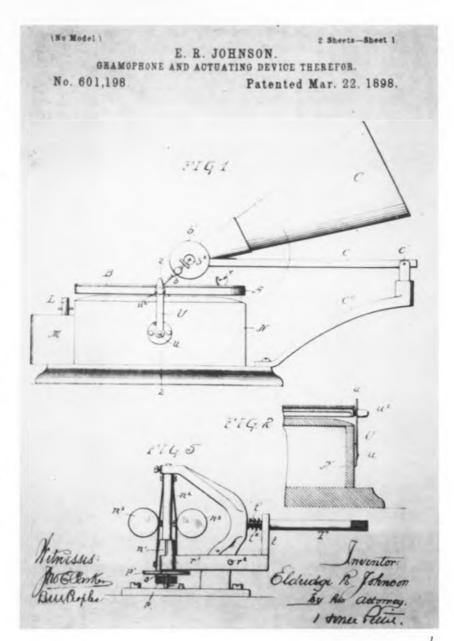
disks; a very fine electrotyped matrix of the recording, and multiple "stampers" made from a master matrix. Johnson employed Messrs. A.C. Middleton and C.K. Haddon to work on the problem. By January 1898, the Johnson process began to take shape. On advice from his lawyers he held off applying for a patent and began to perfect his process under tight security. Mr. William H. Nafey was hired to further develop the recording process. Nafey worked in a room rented from the Collings Carriage Company and, by September 1898, had a workable solution. Johnson finally applied for the patent on August 16, 1898 but, due to the complex legal complications involving sound recording at this time, did not receive the patent until August 11, 1908.

Patent Problems: The Events Which Led to the Victor Talking Machine Company

On October 10, 1896, shortly after Johnson began delivering spring motors for Gramophones, the Berliner Gramophone Company signed a contract with a New York advertising agent named Frank Seaman. This contract gave Seaman and his newly formed National Gramophone Company exclusive sales rights for Berliner's products in most of the United States. Seaman agreed to promote only Berliner's Gramophones and records.

By late 1897, Seaman was not satisfied with his markup and pressed Berliner for a larger profit margin. Both Berliner and Johnson refused to produce inferior, cheaper products in order to make higher profits. So Seaman took matters in his own hands and set up the Universal Talking Machine Company, which built a cheaper copy of Berliner's Gramophone. He called it the "Zonophone" and began advertising it as the "improved Gramophone" in October 1898. This later proved to be an infringement on both the Berliner and Johnson patents.

Meanwhile, Seaman was attempting to set up business in the international market. In 1897, William Barry Owen resigned as Sales Manager for the National Gramophone Company, leaving for London that August to sell European rights to the Berliner patents. Though Owen represented Berliner in this, he ordered Gramophones and records from Seaman for sale in England. While he found many shops interested in selling Gramophones, Owen found it difficult initially to find people to invest in it. Then Owen found a British lawyer named Trevor Williams, who agreed to



- 1) Eldridge Johnson's first patent for Gramophones. This model was an improved version of the Berliner Gramophone. The patent was issued on March 22, 1898.
- 2) The "Zonophone," a cheaper alternative to the Berliner Gramophone, first advertised nationally by Frank Seaman's National Gramophone Company of New York, October 1898.

As to the Improved GRAM=O=PHONE ZON=O=PHONE...

Do not confound it with anything of a similar name or nature
It isn't a "business" machine
You don't "talk into it"

Its sole purpose is that of Entertainment—

Reproducing Everything in Speech or Music, with fidelity to the originals positively marvelous

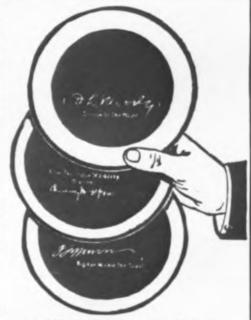
Suited alike to Parlor, Lawn, Yacht, or Exhibition Hall. With an ordinary horn it has been heard in every part of the great Metropolitan Opera House, New York. Its cornet solos have been heard two miles.

Our records are made by experts, from actual performances of the most celebrated instrumentalists, bands, singers, actors, and orators in the world.

These records, instead of being wax, to be kept in cotton, and handled as if they were egg-shells, are on hard, flat disks which are practically indestructible—the only permanent records made.

As a guarantee of authenticity each record (except a few of the earliest ones) is signed. Among the records whose genuineness is thus attested by the autographs of their makers are those of

HON, CHAUNCEY M. DEPEW
ADA REHAN
JESSIE BARTLETT DAVIS
SOUSA'S BAND, BANDA ROSSA, ETC.



Signed Records by Moody, Depen and Jefferson.

CAUTION

The imprecedented popularity of the IMPROVED GRAMOPHONE (ZON=O-PHONE), as a means of entertainment has led to many arrempts at imitation, some of which are most unscrupulous; but the principles upon which the GRAMOPHONE is constructed are covered by parents so local that anything of the same nature approaching it in excellence must be an infringement, and as such will be promptly prosecuted.

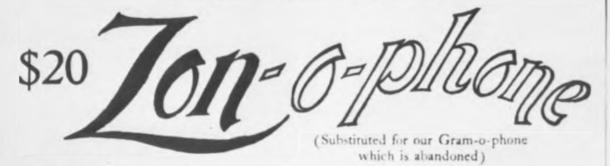
this applies not only to manufacturers and donors, but to USERS; and, pending some already brought, the possess are warned as anot purchasing that which may conset the manufacturers.

Price of the Improved Gramophone (Zon-o-phone) is \$25. Records, 50 cents. For further information, printed matter, etc., address

NATIONAL GRAM-O-PHONE CO., 874 Broadway, New York.

Subscribers to MUNSEY'S MAGAZINE can obtain the Zon-o-phone (improved Gramophone) AT ONCE, by the payment of \$5 cash and \$3 per the for seven months. The National Gramophone Company agree, if the instrument is not satisfactory, to refund the money, less express charges, if returned immediately.

Special Offer to 1000 subscribers of McClure's Magazine



Sent on Approval without Deposit

Science, experience and a happy accident have revealed to us a new and wonderful principle of recording, whereby sound waves are now reproduced which up to three months ago were entirely lost.

THE NEW ZON-O-PHONE RECORDS ARE READY, and so is our new machine to reproduce the records—the new and beautiful Zon-o-phone substituted for the old Gram-o-phone. The new outfit captivates all who hear its results, and experts are amazed at its revelations. We want you to realize that soprano solos executed with operatic trills and cadences; the superb band work of Herbert; the even balance of our peerless quartettes; the shrill, swift vibrations of the piccolo, etc., etc., are all faithfully rendered by this wonderful discovery. Yours on trial for the asking, with no other obligations than to first give the Zon-o-phone and its wondrous records a fair trial at your own fireside, and then to return to us in 24 hours if you are not satisfied.

CONDITIONS: Limited to one thousand as above. Goods ours until returned or paid for. Offer limited to territory east of the Rocky Mountains. The outht—consisting of a Zon-o-phone, complete, with horn, sound box, 200 needles, four Zon-o-phone records—for \$20 cash, or on installments as agreed upon, small payment down and monthly thereafter.

Warning

The public generally is warned again t all attempts to revive or sell the abandoned Gramo-phone, which has been enjoined by the U.S. Circuir Court. The Zon-o-phone is the only legitimate talking machine using disc records, and our machines and records are protected by the allied patents of the four great talking machine corporations.

For Sale by dealers everywhere

NATIONAL GRAM-O-PHONE CORPORATION NO BROADWAY

BRANCHES Providence and Westminster Street

Boston, 178 Tremont Street
Philadelphia, 13 North Ninth Street
Cincinnati, 21 and 23 West Fifth Street



- 1) As the Seaman-Berliner dispute intensified, Seaman stepped up his ad campaign against the Gramophone. Berliner's sales declined heavily as a result. This November 1900 ad appeared in McClure's magazine.
- 2) Johnson's first talking machine, built and sold in December 1900, (the Toy \$3.00) displaying the "His Master's Voice" trademark for the first time (on the horn). Johnson used the trademark with the permission of Berliner's Gramophone Company of Philadelphia, beginning December 1900.

sell both Berliner's records and Johnson's improved Gramophone. [Johnson was issued his first Gramophone patent (US No. 601,198) on March 22, 1898]. By 1898, the Gramophone Company of London was established. Instrument parts were bought from Johnson's Camden, NJ machine shop and the Gramophones were assembled in London.

In 1899, Owen created the Gramophone Company, Ltd., by taking over the assets of the former Gramophone Company. As mentioned earlier, Owen purchased the "His Master's Voice" painting and copyright from Francis Barraud in September of that year. Emile Berliner returned from a trip to London in May 1900 with a copy of the painting and received the US "Trademark for Gramophones" in July 1900.

Between 1898 and 1899, American Graphophone Company and its Columbia subsidiary attacked the Gramophone interests at their weakest point by putting pressure on Frank Seaman. Seaman gave in and made a deal. By a consent decree, he admitted infringing Columbia's patents, in return for which Columbia granted him the right to use the patents.

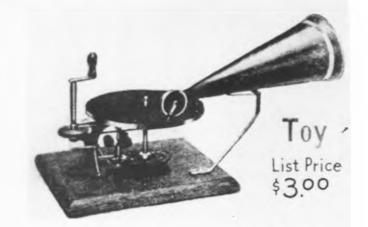
By June 1900, the Berliner Company cancelled Seaman's contract. Seaman retaliated by getting an injunction against Berliner to prevent sales of the Berliner Gramophone to anyone but himself.

INSTRUMENT LINE

Introduced by ELDRIDGE R. JOHNSON

Fall of 1900











- 1) Johnson's first product line, introduced in the fall of 1900.
- 2) Johnson's second 7" disk label, November 1900, which replaced "Improved Gram-O-Phone Record" after a legal injunction by Seaman pressured him to discontinue the use of the word "Gramophone." This label was used until October 1901, when Johnson's Consolidated Talking Machine Company became the Victor Talking Machine Company.
- 3) Johnson's employees pose for a group photo in front of the Machine Shop at 108 N. Front Street (1900). Later that year, operations were moved to 120 N. Front Street. (Note the Nipper imitator in the front row).



Until this time, Eldridge Johnson was not directly involved in the Seaman-Berliner dispute. He was, however, affected. Although business was good with the Gramophone Company Ltd., of London, lost orders dramatically jeopardized his future. Johnson had, by 1900, invested his entire savings of \$50,000-\$60,000 in plant and matrices expansion, anticipating increased orders from Berliner.

Since Johnson could not predict when (or if) Berliner's legal dispute would be resolved, he had to act quickly to protect his investment. He decided to adopt a brand name and to distribute his own products.

The Consolidated Talking Machine Company

Johnson moved his factory operation from the old Scull Machine Shop, 108 N. Front Street, to 120 N. Front Street in early 1900. He produced his first commercial recording on January 12, 1900, using the record label "Improved Gram-O-Phone Record." On June 28, he started his first recording (matrix) log.

By August, with the assistance of Leon F. Douglass, Johnson formed the Consolidated Talking Machine Company. Douglass, experienced in the phonograph industry, arrived from Chicago to accept a job with Berliner. Since Berliner's legal disputes left Douglass waiting,



he teamed up with Johnson.

The Consolidated Talking Machine
Company's main office was in the Stephen
Girard Building in Philadelphia, the metal parts
plant was in Camden and records were pressed
by the Duranoid Manufacturing Company of
Newark, NJ. Johnson then introduced his first
line of instruments, which included the "Toy"
and four other models bearing the "Victor"
trademark. By December, Johnson received
permission from Berliner to use the "His
Master's Voice" Nipper trademark on both his
improved Gramophones and seven-inch disk
records.

Further legal action was taken by Seaman upon learning of Johnson's new Consolidated Talking Machine Company. Berliner had previously set up a holding company over his Philadelphia and Washington DC operations



- 1) Victor's first 10" disk record, bearing the title "Monarch," was introduced on January 3, 1901. It sold for \$2.00. This label was used until February 1902, when it was replaced by the "His
- 2) Johnson's first use of the Nipper trademark on his letterhead. January 7, 1901.

Master's Voice"

trademark.

3) Johnson's first use of the word "Victor" on his letterhead. March 28, 1901.



LONG DISTANCE TELEPHONE

3-27-22

MANUFACTURER OF THE

FACTORY

CAMDEN.N.J.

FACTORY

CA



1

- 4) First letterhead of the Victor Talking Machine Company, November 22, 1901.
- 5) Leon F. Douglass, co-founder of the Consolidated Talking Machine Company and first VP and General Manager of The Victor Talking Machine Company, with his wife Victoria, circa 1900.



5

called the Consolidated Talking Machine Company of America; Seaman brought this up as "evidence" of collusion between Berliner and Johnson. Johnson immediately changed the name of his company to "Eldridge Johnson, Manufacturing Machinist." Yet another legal protest by Seaman resulted in Johnson having to drop the name "Gramophone" from his products.

On March 12, 1901 Johnson was granted the registration of the trademark "Victor," in association with his name. By this point he retitled his improved Gramophone a "Disk Talking Machine."

By June 1901, the order restraining Johnson from using the Berliner Gramophone Company name was reversed, allowing Johnson and Berliner to resume business.

The Incorporation of Victor

The business situation between Johnson and Berliner had become complicated by mid-1901, involving various patents held by each. Johnson's offer to buy Berliner's interest for \$350,000 was refused. Neither could proceed without the patents of the other. Finally, a decision was reached to combine Berliner's patents, Johnson's patents and Johnson's manufacturing activity into a new company.

The Victor Talking Machine Company of Camden, NJ was incorporated on October 3, 1901 with Eldridge Johnson as President and Leon Douglass as Vice-President and General Manager. Other officers were Thomas S. Parvin, Treasurer; Albert C. Middleton, Secretary and Assistant Treasurer; and Horace Pettit, General Council. Albert Atkinson was the daytime plant foreman and his assistant, Charles Haddon, ran the night shift. The new company's board of directors included Johnson (who retained 60 percent of the company stock), Douglass, Middleton, Atkinson and Haddon. Johnson sold \$25,000 of the company's stock to each on a deferred payment plan, eventually making them all multi-millionaires.

Over the years, several stories have surfaced regarding the origin of the word "Victor" and its use in the company's name. One story claims that Johnson considered his first improved Gramophone to be both a scientific and business "victory." A second account is that Johnson emerged as the "Victor" from the lengthy and costly patent litigations involving Berliner and Seaman. A third story is that Johnson's partner in the formation of the Consolidated Talking Machine Company, Leon Douglass, derived the word from his wife's name "Victoria." Finally, a fourth story is that Johnson took the name from the popular "Victor" bicycle, which he had admired for its superior engineering. Of these four accounts the first two are the most generally accepted.

In 1901, Victor's executive and factory offices were moved to 114 N. Front Street in Camden and the sales offices remained in the Stephen Girard Building in Philadelphia. Talking machines were built in Johnson's four-story factory at 120 N. Front Street using cabinets purchased from the Sheip Manufacturing Company. The recording lab remained at Berliner's 10th Street and Lombard building in Philadelphia. Pressing of the seven-inch "Victor" and the ten-inch "Monarch" records was done by the Duranoid Manufacturing

Victor Talking Machine Company's

Original INSTRUMENT LINE











* Entire Trade stock recalled 2/8/02 — Replaced with Improved Monarch #

Company until 1902, when a Camden operation at 23 Market Street was established.

With the incorporation of the Victor Talking Machine Company, operations of the Berliner Gramophone Company of Philadelphia and the Consolidated Talking Machine Company ceased. Johnson acquired the "His Master's Voice" trademark from Berliner and, combining it with his "Victor" trademark, launched an advertising campaign which soon took the world by storm. An agreement was reached with the Gramophone Company Ltd. of London whereby Gramophone could purchase up to 50 percent of Victor's output. Gramophone would have selling rights in the British Empire (excepting Canada) and continental Europe. The Berliner Gramophone Company of Montreal would handle Canada and Victor would sell to the Americas and China.

Also, by 1901, the Columbia Phonograph Company realized the advantages of the disk over its cylinder products and introduced their own disk-playing talking machine. A Victor injunction was filed against Columbia for infringement of the Berliner patent soon after. A cross-licensing agreement between Columbia's selling agency (American Graphophone) and Victor was finally reached in December 1903. From then on, both Victor and Columbia had the ability to produce the same quality products and the selling race intensified.

In the fall of 1901, Victor won its first gold medal over all competitors at the Pan American Exposition in Buffalo, NY. Before the year was complete an organization of 10,000 dealers was established, including the noted Chicago musical firm of Lyon & Healy. Acceptance by Lyon & Healy, the world's largest musical house, greatly enhanced the prestige and commercial appeal of Victor's products.

The revolutionary process of stamping duplicate records from electroplated master disks was further developed and record quality was improved substantially.

By the close of its first business year (December 31, 1901) the fledgling Victor Company's sales were \$500. The first record catalog consisted mainly of selections by military bands, recitations and comedies. The next step was to broaden the base of musical recordings and offer higher quality entertainment to America and the world.



2



- 1) Victor's first product line consisted of five models, all with brass-belled tin horns. Courtesy: Neil Maken.
- 2) The revised "His Master's Voice" trademark, now displaying the word "Victor" for Johnson's new company, October 1901. Johnson spent over \$24 million between 1901 and 1926 to popularize his trademark.
- 3) Victor II, shown here with a rare wood horn, was introduced in 1902.



Enrico Caruso and Red Seal Records

In March 1902, the Gramophone Company sent Fred Gaisberg to Milan, Italy to hear a 28-year-old opera singer who was creating a sensation throughout Europe. His name was Enrico Caruso. Gaisberg was indeed impressed and asked Caruso if he would record for Gramophone. Caruso requested £100 for 10 recordings, a high figure in those days. Gaisberg, nevertheless, proceeded to obtain a contract with Caruso.

On April 11, 1902, Caruso made ten recordings at the La Scala Opera House in Milan. This session was considered by many as *the* most important in the history of recorded music for several reasons. First, it convinced the public that the phonograph had changed from a toy to an instrument for musical entertainment. Second, it convinced other big name artists, who were reluctant to record their voices, to do so. Third, it brought top opera names from the stage into millions of homes.

Caruso's first recordings were heard by Mr. Heinrich Conreid, general manager of the Metropolitan Opera of New York, in the Paris office of Gramophone shortly after. Conreid returned to New York and cabled a contract to Caruso. On November 23, 1903, Enrico Caruso made his debut at the Met in Verdi's Rigoletto.



- 2
- 1) Enrico Caruso in one of his earliest appearances at the Metropolitan Opera in New York, NY. This scene from Aida, February 1904, shows the great Italian tenor at center stage, holding a staff.
- Red Seal label of Enrico Caruso's first domestic recording for Victor: "La donna e Mobile" from Verdi's Rigoletto. Recorded February 1, 1904 in room 826, Carnegie Hall.
- 3) Caruso in his role as Vasco DiGama from L' Africaine at the Met: 1906.



Meanwhile, Victor established its first recording laboratory at Carnegie Hall on March 26, 1903 to begin recording opera artists. On April 24, the first permanent matrix numbering system for recordings began. The following week, on April 30, the first domestic "Red Seal" recording was made. It was "Caro Mio Ben" by Australian contralto, Miss Ada Crossley. The Red Seal label was established by Victor to designate recordings of only the best artists.

Caruso signed his first contract with Victor and on February 1, 1904 made his first recordings for Victor at Carnegie Hall. The recordings were from *Rigoletto*.

The "Red Seal" roster, led by Caruso, continued to grow. Within a year, the list included Emma Calve (soprano), Antonio Scotti (baritone), Johanna Gadski (soprano), Louise Homer (contralto), Marcella Sembrich (soprano) and John Philip Sousa (band master). These famous names removed the final barriers between the great artists and the recording studio. The relationship between Victor and these artists was, indeed, mutually beneficial. Recording for







- 1) A 1903 Victor advertisement in the Cosmopolitan introduces the company's impressive lineup of recording artists as well as its growing list of domestic distributors.
- Johanna Gadski (1872-1932), Germanborn Wagnerian soprano, in her role as "Brünnhilde" from the opera Die Walküre. Gadski began recording for Victor in 1903.
- 3) Marcella Sembrich (soprano) began recording for Victor on October 5, 1904.



Victor enabled the artists to reach the growing thousands of musically minded Americans and, by doing so, increased the artists' fame. Victor benefited financially. Sales grew from \$500 in 1901 to \$3,000,000 in 1904 and \$12,000,000 by 1905.

Victor Advertising (1902-1905)

As early as 1902, the Victor Talking Machine Company began a concentrated effort in national advertising of both its products and artists. Beginning that year with conspicuous back cover ads in The Saturday Evening Post, Victor boasted its growing successes in The Cosmopolitan and The Review of Reviews in 1903-04. Advertising expenses in 1903 were substantial, totaling almost 6 percent of the company's domestic bills. This proved to be worthwhile, since instrument sales of \$615,000 and disk record sales of \$579,000 in 1902 were increased in 1903 to \$683,000 and \$742,000 respectively. General Manager Leon Douglass, who was instrumental in the company's successful advertising campaign, retired and was replaced by Louis Geissler. By 1910, almost all Victor ads in the Post were placed in large, conspicuous places -either as two-page spreads or on the back cover. Victor's advertising played heavily on themes of curiosity and suspense. New record releases were highlighted in ads specifying a certain release date. This was normally done on a monthly basis. The buying public responded enthusiastically, and product sales soared.

- 4) This 1904 Victor ad in The Review of Reviews boasts the company's grand prize received at the St. Louis Exposition for the superiority of its talking machine as a musical instrument over all competing entries.
- 5) By 1904, Victor Black Label records were being produced in four sizes: "Victor" 7-inch (50¢), "Monarch" 10-inch (\$1.00), "Deluxe" 12inch (\$1.50) and "Deluxe Special" 14-inch (\$2.00).





- 1) This 1904 ad in a Camden Board of Trade publication sends three messages to the buying public: 1) Victor's talking machine, sold in Europe by the Gramophone Company Ltd. of London, is an international hit, 2) The new "Deluxe 12-inch" record is now available and 3) The list of Victor domestic distributors now spans the country. Note: Victor's address was listed as Philadelphia, since the sales office was located there at the time. Courtesy: Camden County Historical Society.
- 2) Employees of the newly formed Victor Talking Machine Company on the steps of the first office building at 114 N. Front Street 1902.
- In 1903, Victor introduced twelve-inch disks which were labeled "Deluxe Record."



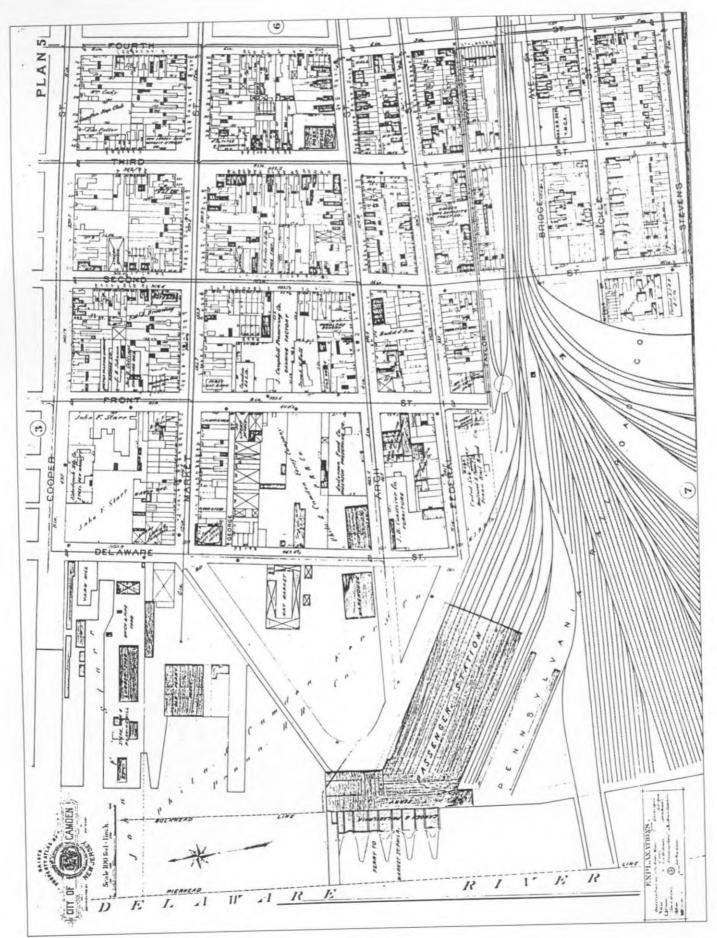
Growth of the Camden Plant (1901-1905)

By 1903, Victor was a rising star on the waterfront of Camden, NJ. The company's net profits had increased to \$495,000 from \$151,000 a year before. Assets included the executive and factory offices at 114 N. Front Street and the four-story brick factory building at 120 N. Front Street. In 1904, the company established its own record pressing operation at 23 Market Street. In addition to the "Victor 7-inch" and "Monarch 10-inch" records, the company introduced the "Deluxe 12-inch" Black Label record on April 24, 1903 and the "Deluxe Special 14-inch" on March 11, 1903. The latter, commercially unsuccessful, was only produced until December 1904. "Red Seal" records were first offered for sale in May 1903 for \$2.50 each.

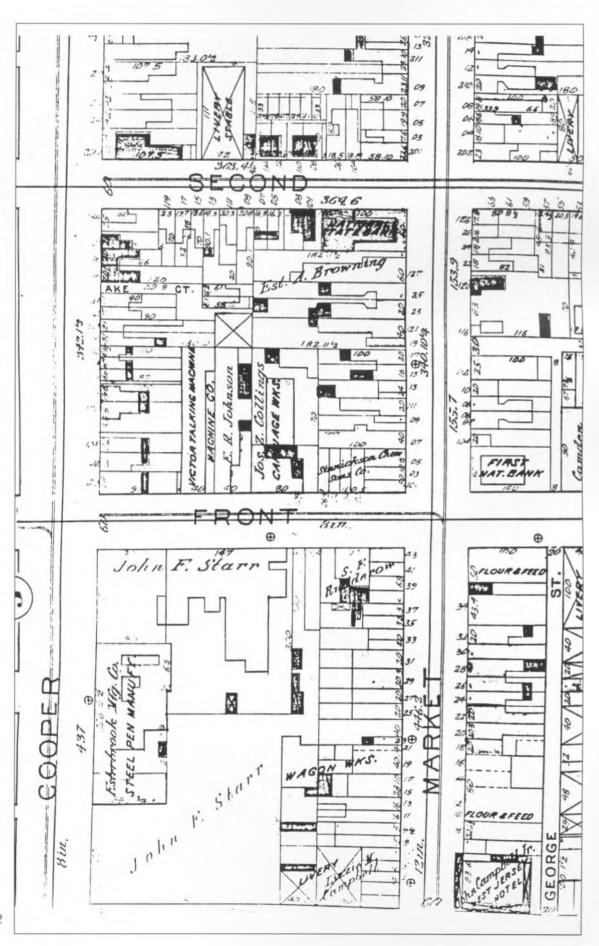
A temporary setback occurred, however, on April 24, 1904, when the factory building was severely damaged by a fire. The company's loss was about \$45,000, which resulted in a decline in net profit for that year to \$424,000. Factory operations were quickly moved to temporary quarters at the corner of Penn Street and Delaware Avenue (later a warehouse for the Campbell Soup Company).

Victor's sales office, which was previously located at the Stephen Girard Building on 12th Street (1901-1903) and at the Commonwealth Trust Building (1904-1905) in Philadelphia, was moved to Camden in 1905. The new location was "old" Building #3, a newly built, five-story structure on the southeast corner of Front and Cooper Streets (later site of present-day Building #8). Old Building #3 was also the new factory building, where exposed horn talking machines were assembled with internally-supplied metal parts and vendor-supplied cabinets.





- 1) This 1903 extract from Baist's Property Atlas of the City of Camden depicts the Camden Waterfront from Cooper Street (top) to Stevens Street (bottom). Note the Pennsylvania Railroad passenger terminal and the Ferry Station, where workers crossed the Delaware River to Market Street, Philadelphia.
- 2) An enlarged section of this plan shows Victor's two buildings: the factory at 120 N. Front Street (titled Victor Talking Machine Company) and the office building at 114 N. Front Street (titled E.R. Johnson).







- 1) The first Victor factory building, located at 120 N.
 Front Street, Camden late 1903. Note the vacant lot next door on the southeast corner of Front and Cooper Streets where the first record pressing factory (old Building #3) was erected in 1905.
 Courtesy: Delaware State Museums.
- 2) On April 24, 1904, a crowd gathered to watch as a fire destroyed much of the factory.



- 3) Homes on the southwest corner of Cooper and N. 2nd Streets, Camden in 1905. A year later these homes were demolished and Victor's first power plant was built on this site (Building #4).
- 4) Victor's one-story power plant (Building #4) backed by the new, six-story metal manufacturing plant (Building #18) on the southwest corner of N. 2nd and Cooper Streets, March 1912.



.

Camden Plant Expansion (1906-1911)

Johnson continued to expand the Camden facilities. In 1906, he acquired a new shipping department and warehouse (Building #6) and a new matrix department (Building #7), both at Front and Linden Streets. These operations were transferred from Philadelphia. Old Building #3 was expanded from four to five stories. Victor's first power plant, a one-story building, was built on the southwest corner of Cooper and N. 2nd Streets.

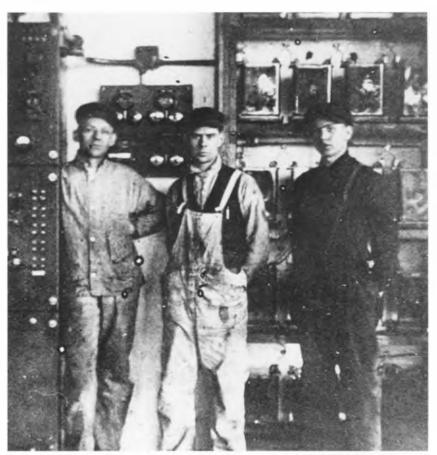
In 1907, the first recording studio and research laboratory (Building #15) was constructed on the southwest corner of Front and Cooper Streets. By November 25, recording operations were transferred to the top floor of the four-story building from the 10th and Lombard lab in Philadelphia. Also, the general offices were moved to the laboratory from old Building #3 (across the street) as well as the matrix department from Building #7. Building #7 became an extension of the Building #6 shipping department. Victor's first cabinet factory (old Building #8) was completed on the southwest corner of Delaware Avenue and Cooper Street (later site of Building #10). A lumber yard was set up on the waterfront behind the cabinet factory.

In 1909, due to the tremendous demand for Victrolas, a second cabinet factory was added (Building #17). The four-story structure was situated between Cooper Street and Delaware Avenue, behind the Esterbrook Pen Company. The power plant (Building #4) was completed, and a coal yard was set up on the waterfront. Throughout the day, a company truck hauled loads of coal, dumping them into a trap door on Cooper Street to the basement furnace room.

In 1910, metal manufacturing operations were expanded with the addition of Building #18, which was erected on N. 2nd Street behind Building #4. Building #15 was expanded from four to seven stories and the recording lab was moved from the fourth to the seventh floor by March 13, 1911.

The Building #17 cabinet factory was expanded from four to six stories and was extended 65 feet eastward by the addition of Building #17A in 1911.

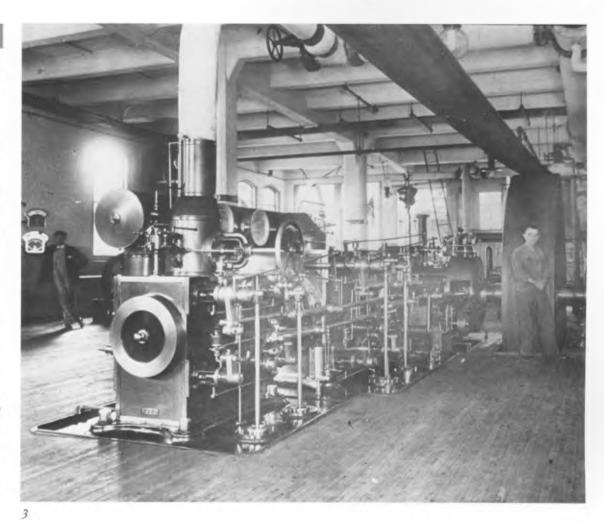
By the end of 1911, the Victor Talking Machine Company had become a completely self-contained operation in Camden. From a single, four-story factory in 1901, the plant had grown to 22 buildings for manufacturing Victor instruments and records.







- 1) Operators of Victor's first power plant, 1910.
- 2) The creation of a new shipping department and warehouse (Building #6) and a record matrix department (Building #7) at Front and Linden Streets in 1906 enabled Victor to further consolidate its businesses in Camden.
- 3) Power generation equipment in Building #4, 1910.
- 4) This Pierce-Arrow truck, driven by Bill Baxter, carried coal from the waterfront yard to the first power house (Building #4). The coal was dumped into a hole on Cooper Street to the furnace room in the basement.







The Victor Talking Machine Company of Camden, NJ – 1910. This view is southwest, from the corner of Cooper and N. 2nd Street. Note the power plant (Building #4, designated by a circled 3) and the metal manufacturing plant (Building #18, designated by a circled 1), the record factory (old Building #3, designated by a circled 4), the recording and research laboratory (Building #15, designated by a circled 5), the



main cabinet factory (Building #17, designated by a circled 8), the second cabinet factory (old Building #8, designated by a circled 12), an experimental laboratory located on the corner where Building #2 was later erected (designated by a circled 19) and the Victor Lunch Club (designated by a circled 20).

The Victrola

By 1905, Johnson's firm had already sold over 200,000 "Victor" talking machines. But despite the instrument's popularity, the unsightly, exposed horn was not considered to be a complementary addition to many homes. Johnson was sensitive to this. As early as 1903, he began to design a machine that would harmonize with beautiful furniture. Gaining ideas from local J.B. Van Sciver Company's retail furniture store, Johnson applied for a patent on December 8, 1904 for his newest machine. In August 1906 the "Victrola" was introduced. Taking fine wood cabinets supplied by the Pooley Furniture Company of Philadelphia, Johnson concealed the horn inside. The ornate product was an immediate success. Selling for \$200, the "Victor Victrola" soon became a standard fixture in homes of the elite.

In 1907 the first Victor cabinet factory (old Building #8) was completed. By August, the Victor-built "Victrola XVI" was being produced in Camden. This model was to become one of the most popular Victrolas, with production in various styles lasting until 1921.

Another new instrument introduced to America in 1906 was the "Auxetophone." Invented in Great Britain and manufactured by the Gramophone Company Ltd., this unique machine used compressed air to amplify sound reproduction. Victor obtained exclusive selling rights in America. Due to its high price (\$500), the market was limited mostly to hotel and restaurant owners. Victor only sold 500 of this model between 1906 and 1918.

Famous German-born contralto Ernestine Schumann-Heink (1861-1936), who sang for the New York Metropolitan Opera from 1899 to 1932, made her first Victor recording on January 3, 1906. She became one of the most renowned "Red Seal" artists, and is best remembered for her stirring rendition of "Stille Nacht, Helige Nacht" (Silent Night, Holy Night).

The introduction of the Victrola in 1906 resulted in the sale of only 506 that first year. Sales, however, increased rapidly over the next four years: 3,559 (1907), 4,317 (1908), 11,764 (1909), and 21,508 (1910) for a total of 41,654 Victrolas between 1906 and 1910.

The following year, 41,956 Victrolas were sold, which was more in that one year than all five previous years combined.



1) The J.B. Van Sciver Company, shown here in a 1912 ad in the Commercial Trade Report, was the largest retail furniture store in the US. Located on Delaware Avenue, a few blocks from the Camden plant, this store inspired Johnson in his design of the "Victrola." Thousands of Victor (and later RCA) employees bought their home furnishings here. Courtesy: Camden County Historical Society.



- 2) The Auxetophone, first invented in Great Britain and manufactured by the Gramophone Company Ltd. in 1904, was introduced by Victor in 1906. Victor had exclusive American manufacturing rights for this unique Gramophone, which employed compressed air to amplify the sound reproduction.
- 3) Ernestine Schumann-Heink (1861-1936), famous German-born contralto, standing beside the new Victor Victrola XVI. Mme. Schumann-Heink made her debut on Victor records in 1906. The Victrola XVI was introduced the following year.



1) Victor began producing double-faced Black Label recordings in 1908. As depicted in this June 1, 1910 recording by Stanley and Burr, the "Victor Record" label was nationally recognized.

2) The "Victor O," introduced in 1908 at the price of \$17.50, was the lowest priced exposed-horn machine with a tapering tone arm. Over 50,000 were produced through 1920.





Advertising and Artists (1906-1911)

With the move of the sales department to Camden and the addition of an in-house printing department, Victor advertising continued to grow. A new trade publication was introduced in April 1906 to keep dealers informed about new record releases, products and sales techniques. It was called The Voice of the Victor and it was issued on a monthly basis. Routine newsletters were also distributed. "His Master's Voice" began to appear on the cover of Talking Machine World magazine and on billboards around the country. Talking Machine World, started in New York City in 1905, was the most widely recognized publication on the phonograph industry in the United States. Patrons of the New York Metropolitan Opera were greeted by a giant 40 x 50 foot illuminated Nipper from atop a building at 37th Street and Broadway. Nipper was fast becoming the most recognized dog in the United States.

Several famous artists joined Victor between 1907 and 1911. In 1907, sopranos Geraldine Ferrar, Emma Calve and Nellie Melba all made their first Victor records. Emilio De Gogorza and Mario Ancona made the first "Red Seal" records in Camden (December 11 and 13).

2

3) The world's earliest Nipper illuminated sign, erected at 37th Street and Broadway, NYC in 1907 by the O.J. Gude Company for Victor. It measured 40' high x 50' wide and contained 1000 electric light bulbs. The dog measured 25' high, the letter "V" measured 19.5' high and the rest of the letters were 8' high.



On February 3, 1908, the sextet of Caruso, Sembrich, Scotti, Journet, Severina and Daddi recorded songs from the opera Lucia di Lammermoor. These records commanded \$7.00 each. That same day, the "Rigoletto Quartet" of Caruso, Sembrich, Jacoby and Scotti was also recorded for the first time. Both sessions were made at the New York studio, which was now located at 234 Fifth Avenue. The following month, on March 16, Enrico Caruso made his first records in Camden. From the seventh floor of Building #15, the legendary tenor's voice was captured by recording engineers (and brothers) Harry, Charles and Raymond Sooy. The "Victor O" talking machine made its debut in 1908, as did the "Victrola Record" label. The first doublefaced "Black Label" records were introduced on September 17, 1908.

In June 1909, the New York studio was moved to 37-39 E. 28th Street. On November 15, Caruso announced that he was renewing his contract with Victor for a period of twenty-five years. Comedian Harry Lauder made his first Victor records in December 1909.



4) Scottish comedian and folk singer Harry Lauder (1871-1950), was famous in every English-speaking country. Later knighted by the British throne, he made his first Victor recordings in December 1909.



An Announcement by Caruso

Caruso in a Characteristic Pose

Nov. 15, 1909.

"Thave renewed the agreement now existing between the Victor Talking Machine Company and myself for a further period of twenty-five years, giving to this Company he existing to make and sell resords of my voice for the entire world."

WICTOR TALKING MACHINE CO.

CAMDEN, N. J., U. S. A.

- 5) World-famous Australian soprano Nellie Melba (1862-1931) was a star at the New York Met and throughout Europe as early as 1890. She began recording for Victor in 1907.
- 6) Victor advertisement of Caruso's announcement of a 25year contract renewal, effective November 15, 1909.







- 1) Irish tenor John McCormack (1884-1945) made his US debut at the St. Louis Exposition in 1904 as a member of the Dublin Catholic Choir. He was a member of the Boston Opera Company (1910-11) and the Chicago Opera Company (1912-14). His operatic roles included the chief tenor parts in Rigoletto, Lucia, Tosca, Don Giovanni, and La Bohème. He achieved great popularity for his singing of Irish songs. McCormack first recorded for Victor on January 3, 1910. He presented this souvenir photo on May 5, 1920 to Raymond Sooy, then chief recording engineer in Camden.
- 2) Austrian-born violin virtuoso Fritz Kreisler (1876-1962) made his first Victor recordings on May 11, 1910. Kreisler was also a successful composer known for "The Old Refrain" and the Broadway score "Apple Blossoms."
- 3) Fritz Kreisler served as accompanist on many of John McCormack's recordings. In this 1910 photo the pair listen to one of their tunes on the Victrola XVI.

4) Romanian soprano Alma Gluck (1884-1938) came to America at age six. Encouraged by husband and famous concert violinist Efrem Zimbalist, Gluck began her rise to fame with the New York Metropolitan Opera Company. She performed in La Bohème, Pagliacci, and Faust. She made her first recordings for Victor in Camden on March 22, 1911. Gluck became the first "Red Seal" gold artist when, in 1915 "Carry Me Back To Old Virginny" sold one million copies.

5) Mischa Elman (1891-1967), Russianborn classical violinist, performed his first solo in Odessa at age five. In 1904, at age 12, he made his professional debut in Berlin. His first appearance in America was in New York, where he played the Tchaikovsky concerto with the Russian Symphony Orchestra on December 10, 1908. Elman began recording for Victor on November 6, 1910.

6) Following a session in the Building #15 Recording Lab in Camden on June 19, 1911, (l-r) Joseph Pasternack, composer Victor Herbert and recording engineers Charles and Raymond Sooy posed on the steps outside for this photo.

Commander Robert Peary came to Camden on January 2, 1910 and recorded his account of his recent discovery of the North Pole. Irish tenor John McCormack started with Victor on January 3. Violinists Fritz Kreisler and Mischa Elman also joined the lineup in 1910, making their first recordings on May 11 and November 6, respectively. The duet of Caruso and Alda from the opera Il Trovatore was released in 1910 at \$4.00 per disk.

The list of popular artists making their first

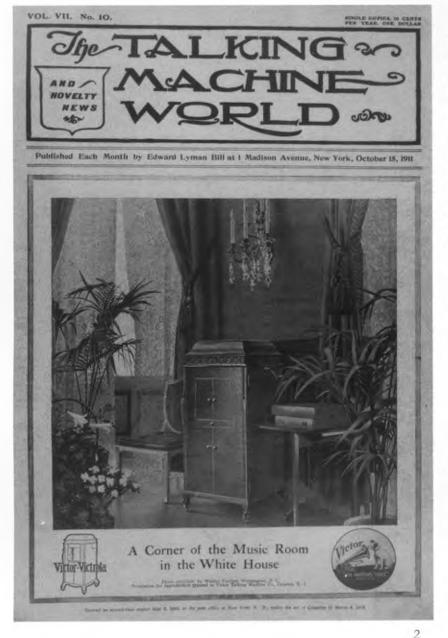
records for the company grew in 1911 to include soprano Luisa Tetrazzini (March 15), Alma Gluck (March 22), George M. Cohan (May 4), Victor Herbert (June 19) and Al Jolson (December).

The "Victrola XI" was introduced in 1910. This model became the most popular of all Victrolas. The first "Purple Label" records, which ranked between the higher-priced "Red Seal" and lower-priced "Black Label," appeared in 1910.









The low cost (\$15) "Victrola IV" was the first table top model in the Victor product line. Beginning shipments on September 1, 1911, the company undercut even Columbia's lowest priced machine. The table top Victrola was an instant success.

The Victor Talking Machine Company
Education Department was formed in April
1911 under the direction of Dr. Frances Elliott
Clark. Its intent was to stimulate public interest
in Victor records and instruments for educational purposes. Special records were pressed
and Victrolas designed especially for school use
were produced. A nationwide campaign
commenced to publicize the program.

From 1901 to 1911 sales totaled 731,523 instruments and nearly 47,000,000 records. The company's common stock, at \$100 per share, was increased from 20,000 to 50,000 shares in 1911. Eldridge Johnson held half of the stock, with the majority of the other half held by other company officials.

- 2) By 1911 Victor ads on the cover of Talking Machine World were almost routine. This October 15, 1911 issue carries a cover photo of a custom-built Victrola purchased by President William Howard Taft for the White House. Victor advertising in 1911 was very effective, as evidenced by a doubling of Victrola cabinet sales from the year before.
- 3) The cover of this September 15, 1911 issue of Talking Machine World tells America that the world's most famous opera singers can be heard only on Victor records. This type of advertising resulted in 1911 sales of nearly 1 million "Red Seal" and 5 million "Black Label" records.

2

1) A 1911 company letterhead displays the now famous trademark flanked by lists of the directors and awards received over the past ten years.



VOL. VII. No. 9.

SINGLE COPIES, 18 CENTS

TALKING SON MACHINES MEWS WORLD

Published Each Month by Edward Lyman Bill at I Madison Avenue, New York, September 15, 1911

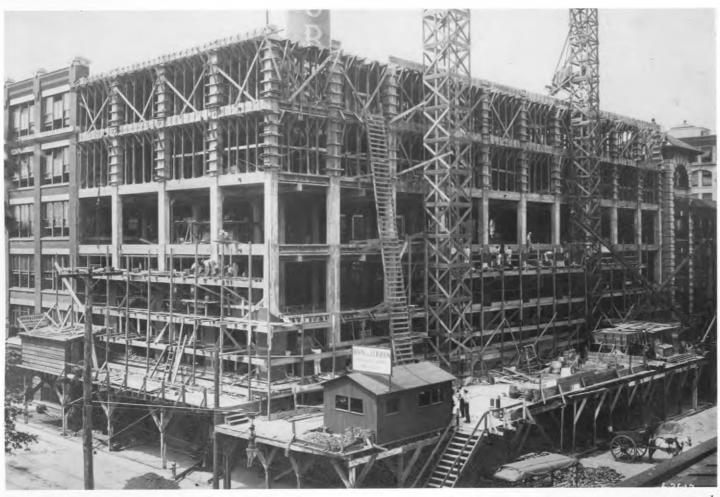


The world's greatest singers make records only for the Victor

The world's greatest singers! The greatest tenors; the greatest sopranos; the greatest contraltos; the greatest baritones; the greatest bassos.

These famous artists—universally acknowledged the greatest, and commanding the highest salaries—make records only for the Victor because only the Victor brings out their voices as clear and true as life itself.







- 1) Southwest view of N. 2nd and Cooper Streets, Camden, showing expansion of Building #4 underway, June 26, 1912. Note the metal manufacturing operation (Building #18) on the left.
- 2) View of expanded Building #4 upon completion, February 14, 1913. The basement and first floor continued to serve as the power plant until 1915. The additional floors were used for record pressing.



- 3) Northwest view of the construction site of the second addition to the Victor cabinet factory (Building #17B), June 11, 1912. Note the existing portion of the factory (Building #17/17A) on the left and the recording and research laboratory (Building #15) on the right.
- 4) Same northwest view of Building #17B, from the corner of Front and Market Streets, upon its completion, January 29, 1913.

Camden Plant Expansion (1912-1918)

As the company continued to grow, so did its assets, with an enormous amount of profit dollars going toward further construction and plant expansion. About half of Victor's entire capital investment was concentrated in the fiveyear period between 1912 and 1917. In 1912, Buildings # 6 and #7 at Front and Linden Streets were enlarged. The printing department was moved from the Locke Building (corner of Delaware Avenue and Cooper Street) to Building #6. The power plant in Building #4 was upgraded with new equipment, affording 4,000 horsepower to handle the growing complex. Five floors were added to Building #4 to accommodate the increasing demand for record production.

The cabinet factory was extended sixtyfive feet eastward along Cooper Street to Front Street and Building #17B was now in place.



In 1913, the metal manufacturing operation (Building #18) was extended westward from N. 2nd to Front Street, running parallel to and behind Buildings #4 and old #3. This new sixstory extension was #18A. An overhead walkway connected #18A with #17B to facilitate delivery of cabinets to the parts assembly area.

Building #13 was constructed in 1914 for the manufacture of record materials. The four-story structure was erected on the waterfront, behind the lumber yard on Delaware Avenue and Cooper Streets.

- 1) Southwest view, from the corner of Front and Cooper Streets, of the Front Street extension to the Victor metal manufacturing operation (Building #18A), May 27, 1913. Note the existing metal manufacturing building (#18) in the background and the Collings Carriage Company on the right.
- Northeast view, from Front Street, of the metal manufacturing buildings upon completion of the Front Street extension (#18A), October 1913. The fourth-floor overhead bridge connected to the cabinet factory (Building #17B).





- 3) Bird's-eye view, looking southwest, of the Camden plant in February 1913. This picture shows the expansion of Building #4 to six stories and Building # 15 to seven stories. The company took the liberty of placing Buildings #6 and #7 (background, center) in this picture. They were actually located several blocks to the right, on Front and Linden Streets.
- 4) Southwest view of the record materials manufacturing operation (Building #13), which was completed in 1914.





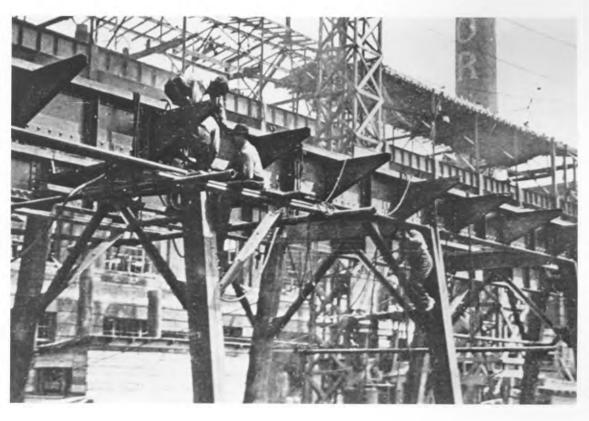


1) Concrete pilings being placed for the new power plant (Buildings #9 and #12), January 8, 1915.

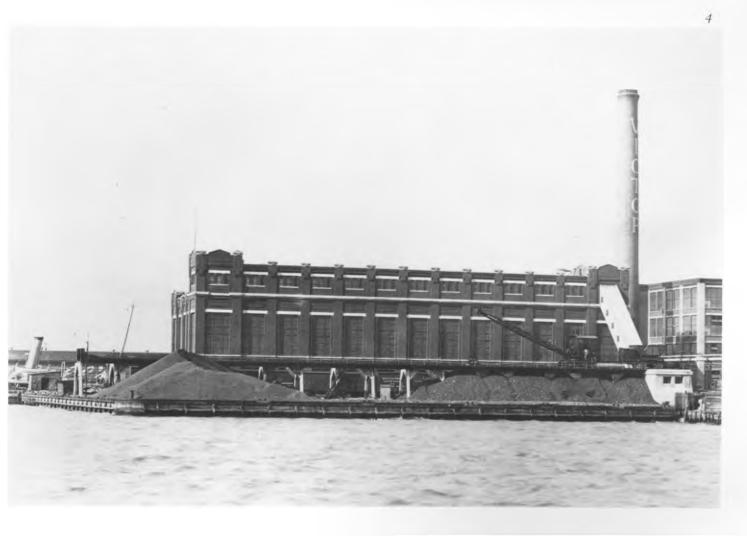
Construction of the new power plant, July 27, 1915.

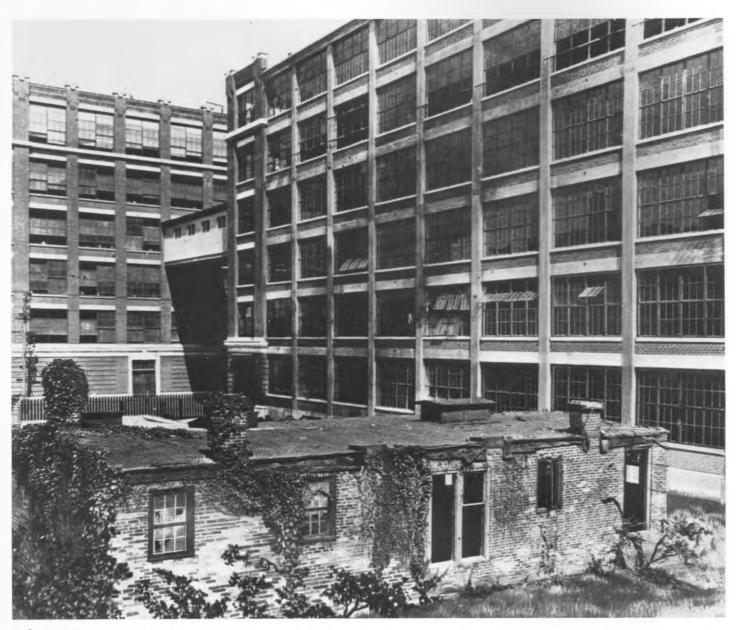
A new power plant (Buildings #9 and #12) was built in 1915 on the waterfront behind Building #13. A new coal yard was set up in a newly-completed storage area on the south side of the new power plant. The storage area was large enough to hold a year's supply of coal. Between the two was an elevated rail, upon which a large crane maneuvered the coal from the yard to the conveyor belt. The coal was moved up the conveyor and dumped into the numerous storage bins along the rafters of the plant.





- 3) Construction of the elevated rail for the coal-hauling crane between the coal yard and new power plant, August 1915.
- 4) The newly-completed power plant, November 1915. Note the coalcarrying crane and enclosed coal conveyor system on the right end of the building. The record materials manufacturing operation (Building #13) is visible to the right of the smokestack.



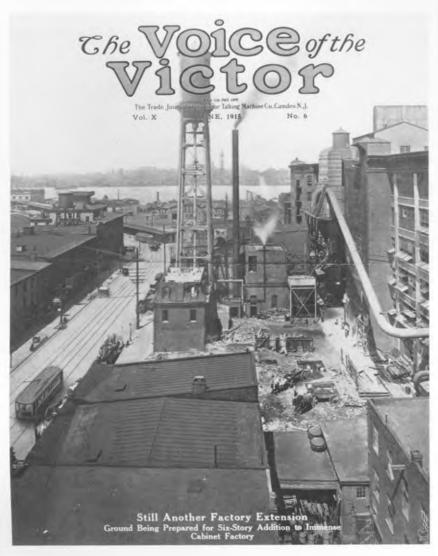


Another new addition in 1915 was the sixstory shipping department (Building #1) on the northeast corner of Front and Market Streets. Across the street, yet another extension to the cabinet factory was completed. Known as Building #17C, it ran the remaining length of Front Street southward, and halfway along Market Street westward, toward the waterfront. Overhead bridges connected Buildings #17B to #18A, #17C to #1 and #18A to #1. The joining of the cabinet factory, metal manufacturing, final assembly and shipping buildings with overhead bridges resulted in a further streamlined and efficient operation from sub-assembly to final packing.



- 1) This 1914 photo was taken just prior to construction of the new shipping department (Building #1). This view is northwest looking from N. 2nd Street. Eldridge Johnson's first machine shop at 108 N. Front Street, long abandoned and overgrown with ivy, is flanked by the metal. manufacturing operation (Building #18A) on the right and the cabinet factory (Building #17B) on the left. The old machine shop was demolished in 1914 to make way for Building #1.
- 2) A view of the new shipping department (Building #1) on the northeast corner of Market and Front Streets, Camden, upon completion in 1915. Courtesy: Ballinger.
- 3) Looking east from Front Street through the long courtyard between the metal manufacturing department (Building #18A, left) and the newly-completed shipping department (Building #1, right). Note the overhead bridge, across which completed Victrolas traveled by conveyor to the packing plant.





An interesting design feature of Building #17C was the ramp at the west end, which served as an efficient means to evacuate the cabinet factory in an emergency. The eleven-foot-wide ramp spanned all six floors. Two pipe rails were placed at the bottom of the ramp to prevent congestion at the five exit doors. During fire drills, nearly 5,000 people exited in only fifteen minutes. Another safety feature was the stairway design. Fireproof stairs were enclosed in brick walls, separating them from the main building. Entrance to a floor required passing through an exterior balcony. This design was applied to Buildings #17, 17A and 17B as well.

1) Westward view (from Building #1) of the area along Market Street under construction for the Building #17C addition to the cabinet factory, May 1915. Note the location of the elevated water tank. The "Nipper Tower," erected at this spot later in the year, served as the new location for the water tanks. This photo appeared on the cover of the June issue of The Voice of the Victor.

-

2) Construction site for the next addition to the Victor cabinet factory (Building #17C), looking northwest from the corner of N. 2nd and Market Streets, May 1915. Note the existing six-story factory (#17, #17A and #17B).

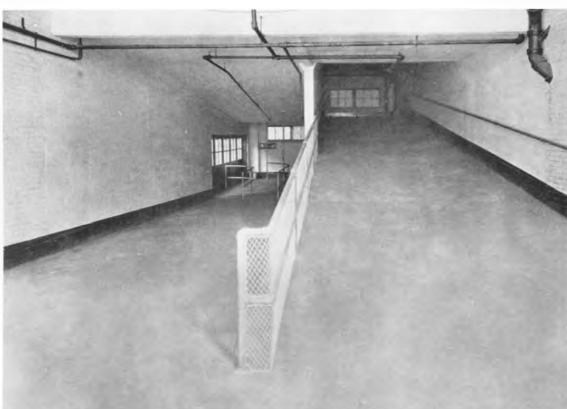




- 3) Close-up view of the Building #17C construction site, looking southwest, May 20, 1915.
- 4) Northwest view of Building #17C on July 30, 1915 shows all six stories framed with reinforced concrete.







- 1) Interior view of Building #17C, showing work crews installing windows, September 9, 1915.
- 2) The inclined walkways, designed by Ballinger and Perrot, were a unique feature of Building #17C.

 Over 4,000 people daily passed in and out quickly and without confusion.



- 3) The overhead bridge connecting the fourth, fifth and sixth floors of the newest extension to the Victor cabinet factory (Building #17C, left) to the shipping department (Building #1, right) under construction, October 4, 1915.
- 4) Interior view of the new addition to the cabinet factory (Building #17C), where hundreds of completed Victrola cabinets await transport to the metal manufacturing operation for motors.





BALLINGER & PERROT AMBRITANE PHILADELPHIA AND NEW YORK

PRINTING BUILDING AND GARAGE
VICTOR TALKING MACHINE COMPANY
CAMDEN, N. J.

New construction at Victor's Camden, NJ plant continued at the same rapid pace in 1916. Building #5 was erected on the north end of #7 on Front and Linden Streets. It served as a warehouse, printing department for record labels and catalogs, and garage for the company's delivery trucks.

A new dry kiln (Building #11) was built on the south side of the record materials manufacturing operation (Building #13), situated between Delaware Avenue and the waterfront coal yard in 1916. Later that year the lumber yard was moved to the northeast corner of State Street and River Road (#50), Camden.

- 1) Southeast view of Victor's new printing department and company garage on the corner of Front and Linden Streets, 1916. Note Building #7 (five stories) on the right. Courtesy: Ballinger.
- 2) Westward view of the site for the new dry kiln (Building #11) on the Camden waterfront, 1916. Note the four-story record materials manufacturing department (Building #13) and the new power plant (Building #9 and #12) in the background.
- 3) This 1916 photo, taken from the roof of the executive office building (#2), shows Victor employees leaving at the end of the work day. Note the lumber yard (moved to State Street and River Road later that year) and the new dry kiln (#11) adjacent to the four-story record materials manufacturing building (#13).



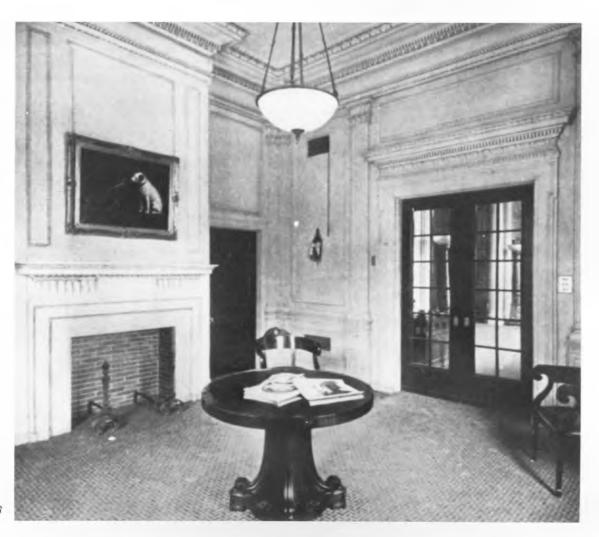


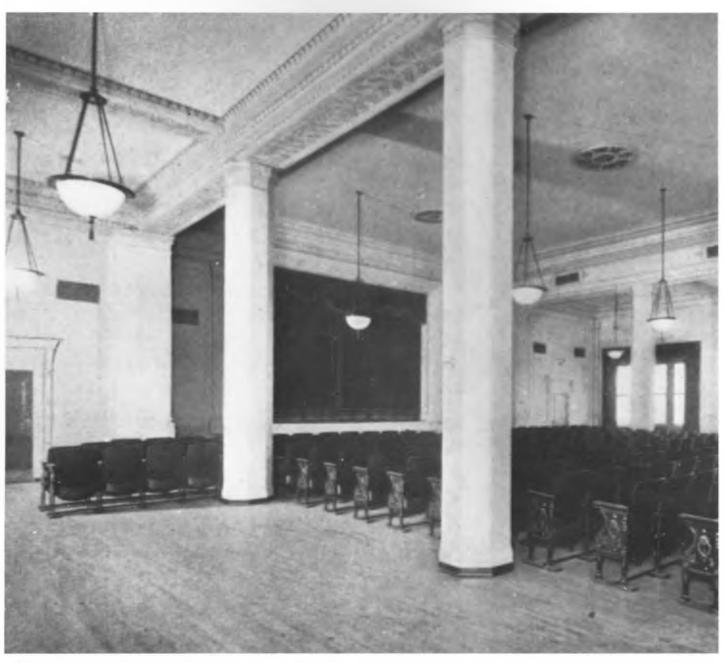


One of the most notable additions to the Camden plant of the Victor Talking Machine Company was the new executive office building, completed in January 1916. Located on the northwest corner of Front and Cooper Streets, Building #2 was an impressive architectural achievement. The eight-story, ornate edifice was designed with domestic character. The wide, tiled lobby, flanked on either end by reception rooms, opened into a large stairway and elevator hall. The layout was very similar to a hotel. Each floor had a unique design, requiring individual mechanical and architectural layouts. Intricate systems of ventilating ducts, electric lighting and telephones were designed and built. The design was such that rooms could be enlarged or sub-divided, allowing flexibility in accommodating future departmental realignments.



- 1) The newlycompleted executive office building (#2) of the Victor Talking Machine Company, January 1916. Courtesy: The American Architect magazine.
- 2) Entrance lobby of the Victor executive office building (#2), 1916.
- 3) One of the two reception rooms adjacent to the entrance lobby of Building #2, 1916.





1) The eighth-floor auditorium of Building #2, used for orchestral recording sessions from 1917 to 1918, was the site of numerous Victor social gatherings throughout the 1920's. The eighth floor of Building #2 was an auditorium, which served as both a banquet hall and theatre. Johnson used it for employee dinners, entertaining clients and, from 1917 to 1918, orchestral concerts and recording sessions. The first recordings of the Philadelphia Symphony Orchestra were made here on October 22, 1917. A service elevator was built on the west end of the building to support these events. There was a pantry, kitchen and even dressing rooms for the performing artists. The maple floor was excellent for dancing. There was a state-of-the- art sound and film system.

On the seventh floor, the president's office

and board room were custom paneled in Circassian walnut, as was the accompanying custom-designed furniture. All hardware was custom designed in brass. The floors were teak. The fireplace in the board room was accented by an old Italian marble mantel.

Another interesting feature of Building #2 was the system of synchronized clocks, controlled from a master clock which was tied into Western Union's lines. Each floor had two fire alarm boxes and six watchman's stations. A central vacuum cleaner system provided two connections per floor. There was also a centralized system for filtering and refrigerating water.



- 2) The office of Eldridge R. Johnson, President of The Victor Talking Machine Company, on the seventh floor of Building #2, 1917.
- 3) The director's board room, viewed from the doorway of the president's office, on the seventh floor of Building #2, 1917.







Exterior highlights of Building #2 included all-metal window casements, with the first and second levels made of bronze. An ornate cornice on all four exterior corners, between the sixth and seventh floors, proudly displayed the letter "V." The main entrance was dominated by two 20-foot high corinthian columns, topped by another cornice with the inscription "Victor Talking Machine Company." Finally, situated above the ornate bronze doors and below the second floor balcony was a circular bronze plaque of the famous Nipper trademark.

Needless to say, Building #2 was, and remains today, an architectural masterpiece.

Following completion of the new executive offices (Building #2), Johnson ordered construction of a new library building across the street on another plot of land owned by Victor. The new building and surrounding land, occupying one square city block between Penn, N. 2nd, Cooper and Front Streets, were donated to the City of Camden. The building became the Cooper Branch Free Public Library and the land was designated as Johnson Park in recognition of Mr. Johnson's generous gift to the city. Worthy of mention is the beautiful mosaic situated over the entrance to the library. It was designed and produced by the D'Ascenzo Studios of Philadelphia. The mosaic was put in place upon completion of the sandstone library in 1916. That same year, D'Ascenzo was also designing four stained glass windows for another Victor project: the "Nipper Tower."



.

- 1) Administrative department personnel passing through the bronze-door entrance of the new office building (#2) (from the July 1916 issue of The Voice of the Victor).
- 2) Among Eldridge Johnson's numerous philanthropic deeds was the construction in 1916 of the Cooper Branch Free Public Library, funded by Johnson and donated to the City of Camden. In 1921, Johnson also donated the land surrounding the building, which became Johnson Park. It extended from Penn to Cooper Street and from N. 2nd to Front Street.
- 3) The fountains of the Cooper Branch Free Public Library were used as wading pools by the youngsters of Camden in the 1920's.

The hallmark of the Camden plant was established with the completion, also in 1916, of the last section of the cabinet factory. For it was atop Building #17D that the famous "Nipper Tower" was built. This 75-foot-high monument, rising from the roof of the six-story building, proudly illuminates the "His Master's Voice" trademark in handcrafted, 14.5-foot diameter stained-glass windows on all four sides. The windows were designed and built by the famous D'Ascenzo Studios of Philadelphia. The D'Ascenzo Studios, under the direction of Nicola D'Ascenzo, Sr., began designing and crafting stained-glass memorial windows in 1896. Notable works by D'Ascenzo included the National Cathedral, Washington, DC; Cathedral of St. John the Divine, New York City; the Cathedral Church of Christ, Philadelphia; Princeton University Chapel, Princeton, NJ; University of Pennsylvania, Philadelphia; and the Cooper Branch Free Public Library, Camden, NJ.



- 1) Pile driving foundations for the fourth and final extension to the Victor cabinet factory (Building #17D), May 1916. The view is eastward from Delaware Avenue.
- 2) Building #17D, October 4, 1916. Note the mock-up of the Nipper stained-glass window being positioned for the tower design.
- 3) Same view of Building #17D, near completion, November 1916.

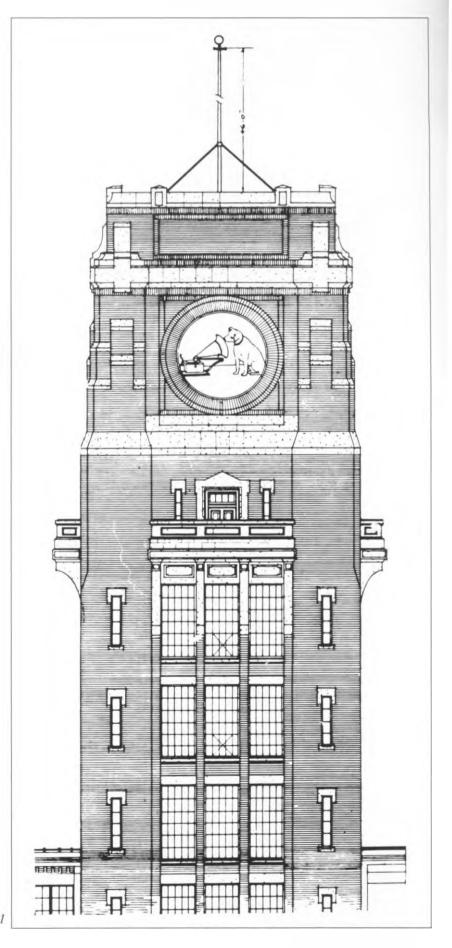


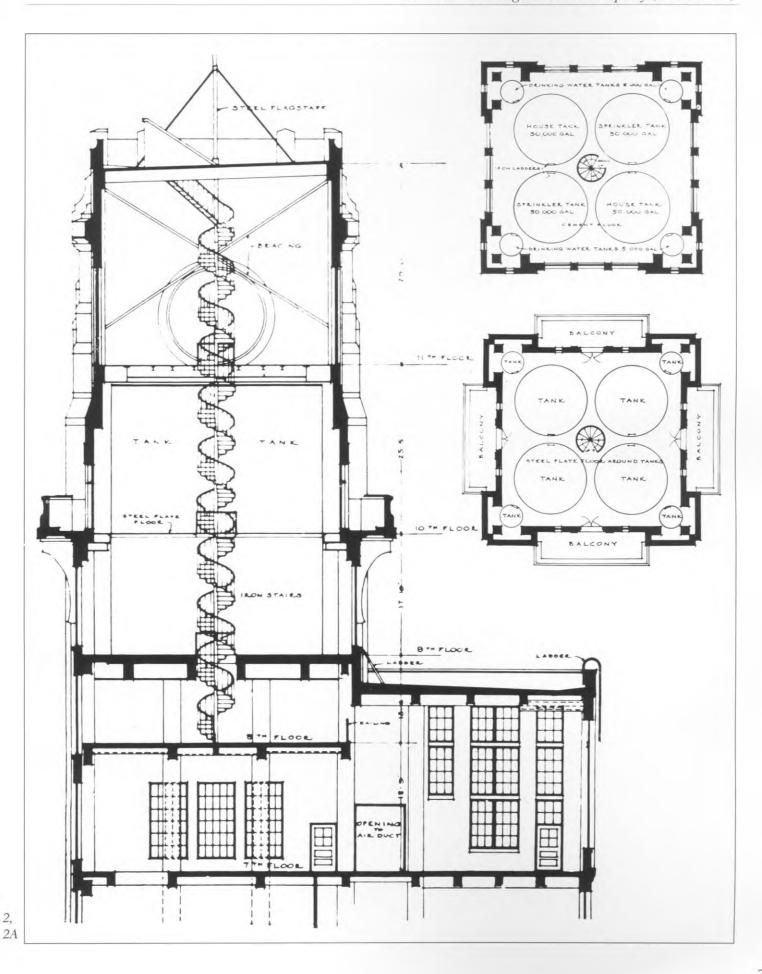


The idea behind the Nipper Tower was to house the unattractive water supply tanks in an attractive tower. The result was an artistically dominating point of interest in the Camden skyline, which sharply contrasted the numerous unsightly water towers of neighboring factories. The tanks within the Nipper Tower were housed on the ninth and tenth floors. There were four 50,000 gallon tanks, two for the sprinkler system and two for sanitary purposes. Each measured 14 feet in diameter and 40 feet high. They held water which was supplied from the Delaware River via pumps in the basement of the power house 1500 feet away. Additionally, there were four 5,000 gallon drinking water tanks, which were supplied with city water. Each measured nearly 5 feet in diameter and 40 feet high.

With the completion of Building #17D in 1916, the Victor cabinet factory stretched 443 feet between N. 2nd Street and Delaware Avenue and 270 feet between Market and Cooper Streets.

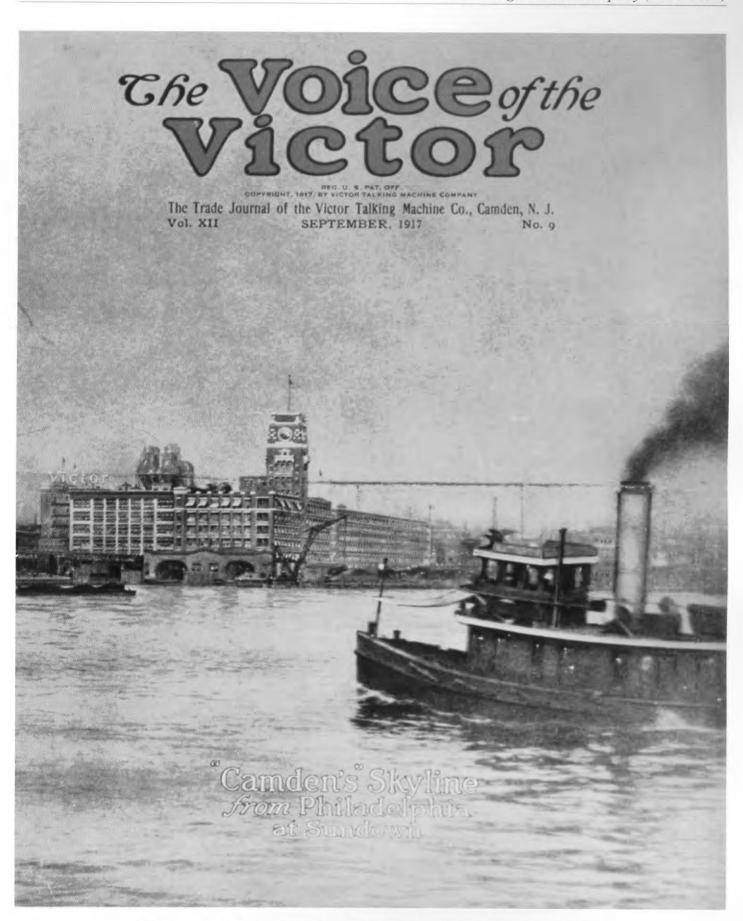
- 1) The front face of the Nipper Tower, looking north from Market Street, from the original architect's design in 1915.
- 2) Westward view, showing the floor plan of the Nipper Tower. A wrought iron spiral staircase began on the eighth floor, rose between the four large water tanks on the ninth and tenth floors and continued past the stained-glass windows on the eleventh floor to the roof-top access.
- 2A) Top-down view of the ninth and tenth floors of the Nipper Tower, showing the layout of the four 50,000-gallon and four 5,000-gallon water tanks.







Newly-completed Building #17D, with Nipper stained-glass windows displayed from the eleventh floor, May 1917.



The Victor Cabinet Factory, viewed from Penn's Landing, Philadelphia, September 1917.



- 1) Close-up of one of the "Nipper windows," photographed from inside the tower of Building #17D (reversed photo negative).
- 2) View of the "Nipper Tower," looking south. Rising 11 stories from the ground, the tower measures 33' x 33' x 75'. When lighted at night, the trademark can be seen from Philadelphia and surrounding communities as far as five miles away.

The four stained-glass windows, at a total cost of \$25,000, were placed in the tower in 1916. For the next 53 years, Nipper faithfully sat high above the Camden waterfront. RCA, successor to Victor at the Camden plant since 1929, removed the four glass panels and replaced them with a new "RCA" block-style logo in April 1969. One Nipper window was donated to the Smithsonian Institution, another to Penn State University and a third to Widener College, Chester, PA. The fourth was retained by RCA until 1988, when it was donated to the Camden County Historical Society. At the time they were removed, the total value of the original four windows was \$100,000.

In 1978, RCA re-instituted the famous trademark and commissioned the D'Ascenzo Studios to build four new windows. On April 10, 1979, the new Nipper windows were dedicated, ten years to the day from when the original windows were dismantled. That day was proclaimed "Nipper Day" in New Jersey by Governor Brendan Byrne. Today the Nipper tower remains one of the most famous landmarks in the Delaware Valley.



An impressive tunnel system connected the majority of the buildings in the Camden complex. Beginning at the old power house (Building #4) the tunnel ran through the shipping department (Building #1), crossed Front Street to Building #17C and connected with the basement of #17D. From here, three more tunnels crossed beneath the cabinet factory courtyard, one each to #17, #17A and #17B. On the west end of #17 was a shipping platform, under which was another basement. From here, another tunnel crossed Delaware Avenue, passing through the dry kiln (Building #11) and connected with the basement of the new power house (Buildings #9 and #12) on the waterfront. Finally, a tunnel connected the executive offices (Building #2) with the recording and research laboratory (Building #15), across Cooper Street and another connected Building #15 with the first record pressing plant (old Building #3), across Front Street.

A new warehouse (Building #53) was also

completed in 1917. Situated on the northeast corner of State Street and River Road, this warehouse was used for the manufacture of detonator cases, shell parts and other war materials through 1918.

In February 1918, Victor purchased Trinity Church, 114 N. 5th Street, Camden. The church was intended to be used for storage, but it was soon realized that it would serve a much more useful purpose. With its fine acoustic qualities, the church was converted to a recording studio and titled Building #22.

By the end of 1918, the Camden plant totaled 1,663,552 square feet of factory floor space, with plans underway for construction of an additional 218,013 square feet. The company had over 16 acres of lumber piled from twenty to fifty feet high, which was used at a rate of 36,850,000 feet per year. Over 55,000 tons of coal were burned per year to generate the power for the growing complex. And there was further growth yet to come.

3) Trinity Church, 114 N. 5th Street, Camden, was purchased by Victor in February 1918. Also known as Building #22, the church served as a recording studio for disk records (1918-1928) and as a motion picture soundtrack recording studio (1928-1935).



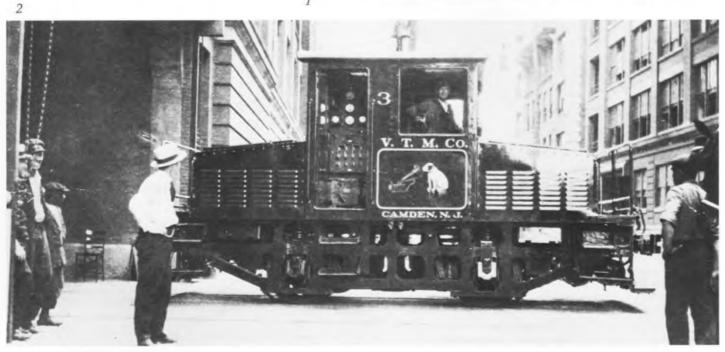
Victrola Production Operations

From Victrola assembly to final shipment, Victor's streamlined operations were much like those of the automobile industry. By 1915, a series of overhead bridges connected the buildings of the cabinet factory, metal manufacturing and shipping departments. Completed Victrola cabinets passed from Building #17B to #18A on conveyors where motor assemblies were next installed. Another conveyor brought the finished product to the shipping department (4th floor, Building #1). The instruments were sealed in veneer cases with screw guns.

From here, the crated cases made their way via gravity conveyors and elevators to the trackside loading docks. Here they were loaded onto

- 1) Completed Victrolas, passing via overhead conveyor systems from the final assembly area of Building #18A to the shipping department in Building #1, were carefully packed in veneer crates, sealed with screws and sent down to the trackside loading area for shipment.
- 2) This electric switch engine was used to haul boxcars between the shipping department (Building #1) and the waterfront, where the lumber yard and Pennsylvania Railroad were located. In this 1916 photo, the engine is on Cooper Street between the cabinet factory (Building #17C, left side) and the shipping department (Building #1, right side).

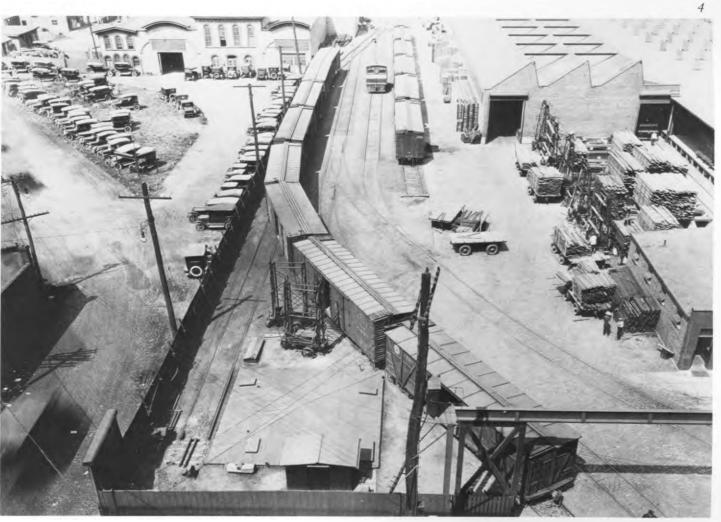






boxcars and shuttled by Victor's electric switch engine through a 38-foot-wide courtyard, which separated Buildings #17, #17A and #17B from #17C and #17D. Emerging from the courtyard, the switch engine crossed Delaware Avenue to the waterfront station of the Pennsylvania Railroad. From here, the freight was shipped by rail to major cities across the east coast. This system of streamlined production enabled the company to increase output at a much higher rate of efficiency.

- 3) View of the cabinet factory, looking east from the dry kiln on the waterfront, 1923. Note the railroad tracks leading into the tunnel of Building #17D. Boxcars were transported through this tunnel, crossing the cabinet factory courtyard and Front Street, to the loading dock of the shipping department.
- 4) View of the railroad tracks on the waterfront, looking west from the cabinet factory.



Advertising and Artists (1912-1918)

Significant sums continued to be invested in publicizing Victor products and artists between 1912 and 1918. Advertising through newspapers, magazines, billboards and storefront windows of dealers increased at an incredible pace. The printing department in Camden, expanded in 1916 after its move to the newly-constructed Building #5, produced record and instrument catalogs and other promotional items for distribution to dealers coast-to-coast.

- 1) Early Victrola advertising on a Ford Model T by a New York dealer, circa 1915.
- 2) Billboards like this were a very effective advertising tool used by Victor for over 20 years.
- 3) This elaborate ad appeared as a double-page spread in The Saturday Evening Post on February 15, 1913. No less than 36 artists, from grand opera to musical comedy, were pictured. The four Victor instruments, from the \$25 "Victrola VI" to the \$200 "Victrola XVI," were shown to emphasize that there was a Victrola to fit every purse. Courtesy: Neil Maken Yesterday Once Again.







The Victor Traveling Department, a twenty to thirty-man operation headquartered in the general offices (Building #2), was established to help dealers improve sales techniques and increase their volume. The company introduced new Victrola instrument lines almost every year. The new models, distinguished only by subtle design changes, were nevertheless advertised with great fanfare. The response was positive. Orders from dealers were so large, the instruments could not be built fast enough to fill them. Dozens of distributors came to the Camden plant every day to try to convince the Orders Department (Building #2) to increase their shipments. To straighten out this situation, in 1919 the company started a plan by which shipments were based on distributor performance. Top-performing distributors received highest priority for quantity and timeliness of shipments.

Many new milestones were reached in recording activities between 1912 and 1918. Woodrow Wilson recorded messages for his presidential campaign at the New York lab on September 24, 1912. The first Victor "Blue Label" records were introduced in 1912. They were double-sided, replacing the discontinued, single-sided "Purple Label" disks.

To satisfy the growing demand across America for dance music, recordings by the Victor Band commenced in January 1913. Violinist Jan Kubelik made his first Victor recordings on September 30, 1913. He was followed by tenor Giovanni Martinelli on December 24. Polish-born pianist Ignace Paderewski had his first Victor session on April 29, 1914.

A memorable recording event occurred on February 11, 1915. Victor engineers recorded the tapping of the Liberty Bell by Mayor Smith of Philadelphia, which was transmitted by wire to San Francisco to signal the opening of the Pan American Exposition.

5) Victor's extensive advertising of Caruso through the years gave the legendary tenor valuable publicity, while bringing increased prestige and business to the company. This 1915 ad from Literary Digest is a typical example.



4) Ignace Jan Paderewski (1861-1941), Polish-born pianist and composer, first achieved international fame in 1888. He first recorded for Victor on April 29, 1914.



1) On February 11, 1915, Victor engineers, led by Raymond Sooy, recorded the tapping of the Liberty Bell by Philadelphia's Mayor Smith, which they transmitted by wire to San Francisco to signal the start of the Pan-American Exposition.

2) Acoustic recording of the Victor orchestra, led by Rosario Bourdon, in the 7th floor studio of Building #15, September 1916. Note how the musicians had to crowd around the horn.





On October 30, 1916, soprano star Amelita Galli-Curci made her debut on Victor records. Rosario Bourdon succeeded Walter B. Rogers as Victor's musical director on September 1, 1916. Bourdon only held the post until October 16, when violinist/cellist Josef A. Pasternack assumed the job.

The New York studio was moved again on January 19, 1917, this time to 46 W. 38th Street. In Camden, with the completion of Building #2, the first full orchestral recording sessions began. A 51-piece ensemble, organized by Pasternack, made the first recordings in the eighth-floor auditorium on July 23, 1917. The first Victor recordings of the Boston Symphony Orchestra, directed by Dr. Karl Muck, were made here October 2-5, 1917. Leopold Stokowski conducted the Philadelphia Symphony Orchestra for its first Victor sessions on October 22. Russian violinist Jascha Heifetz first recorded for Victor on November 9. The "Red Seal" label on disks was changed to read "Victrola Record" in 1917.



- 3) Josef A. Pasternack (1890-1960), noted violinist/cellist, became Victor's musical director on October 16, 1916. Courtesy: Delaware State Museums.
- 4) Following a successful recording session from the opera Lucia Di Lammermoor, the sextet pose for a photo on the steps of Building #2, Camden. Caruso was joined by De Luca, Journet, Galli-Curci, Bada and Egener for the January 25, 1917 session, held in the eighth-floor auditorium.



With the purchase of Trinity Church of Camden (Building #22) in February 1918, Victor's orchestral recording sessions were moved there from Building #2. The company's top artists, as well as choirs and symphony orchestras recorded there. The Vatican Choir recorded there on October 9, 1919. By 1925, the studio was converted to motion picture soundtrack recordings. Phonograph recording activities were moved from Camden to the New York studio, which had relocated to 28 W. 44th Street. One of the earliest efforts in soundtrack recording was for the 1927 motion picture Wings, starring Clara Bow and Charles "Buddy" Rogers. The music and sound effects were

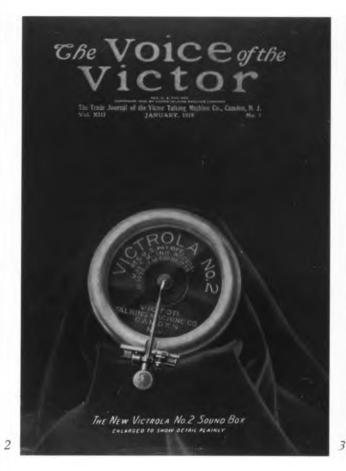
recorded to synchronize with the scenes of this silent film. *Wings* won the first Oscar for best picture in 1928.

Subway construction beneath the church in 1935 brought an end to all recording activities. It then served as the recreation hall for the Victor Athletic Association and later as the RCA Victor Employee Sales Store. The building was eventually demolished.

Recording activities between 1912 and 1918 were extensive, and many milestones were achieved. One of the most notable occurred in 1915, when Alma Gluck's "Carry Me Back to Old Virginny" became Victor's first "Red Seal" million seller.

- 1) Leopold Stowkowski, shown here during a 1932 electrical recording session, led the first sessions of the Philadelphia Symphony Orchestra for Victor in October 1917. The first sessions were held in the eighthfloor auditorium of the general office building (#2) in Camden.
- 2) A major technical achievement made by Victor's engineers was the improved "Victrola No. 2" Sound Box, developed in 1917 and announced to dealers in this January 1918 issue of The Voice of the Victor.
- 3) Jascha Heifetz, one of the most acclaimed violinists of the 20th century, was born in Russia in 1901. At age three he began to play. He entered the Royal School of Music at Vilna at age 5, graduating four years later. In 1911, Heifetz gave his first recital in St. Petersburg (Leningrad). He made his American debut at Carnegie Hall in 1917 and recorded for Victor for the first time that same year.
- 4) Summertime relaxation with the Victor Victrola and records, June 1918.
- 5) Enrico Caruso, the greatest of all Victor "Red Seal" artists, pictured here in November 1918.











Conversion to Military Equipment Production (1917-1918)

The United States entered World War I in 1917 and the Victor Talking Machine Company answered the call for support.

Special recordings were made and records pressed for military skills training. The first of these was a recording of wireless telegraph operations for training purposes on May 5, 1917. Victrola and record production in 1917 was high. Table-top Victrola sales peaked that year at 278,971, due partly to the popularity of the inexpensive "Victor IV" with the troops.

By 1918, however, the US Government began to ration raw materials to the manufacturing industry. Steel was especially in short supply, which forced Victor to severely curtail Victrola production. The company began accepting Government contracts for military equipment production. The metal manufacturing department in Building #18 converted to production of rifle fittings. Detonator cases and shell assemblies were made in the Building #53 warehouse. The cabinet factories (Buildings #17A-D) were dedicated mainly to production of rifle stocks and fabric-covered wooden airplane wings.

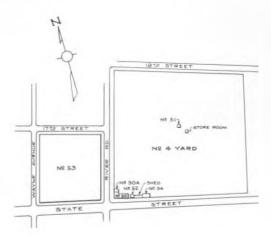


- 1) The inexpensive "Victrola IV" was a favorite with US troops during World War I. Due to material shortages and inflation, the price of this \$15 table-top jumped to \$20 in October 1917, \$22.50 in May 1918 and \$25 in September 1919.
- Soldiers gathered around a Victrola IV for a training class in 1917.
- 3) Layout of Victor's facilities at State Street and River Road, Camden, 1918. The lumber storage area (#50) was moved here from the Delaware Avenue waterfront in 1916. Building #53 was built as a warehouse in 1917 and was converted to war materials production the following year.
- 4) Lumber for the construction of airplane wings was stored at the new yard (#50) in 1918. Courtesy: Delaware State Museums.
- 5) William B. Stevenson, Victor plant manager, contributing to the American Red Cross in support of the war effort, 1918. Courtesy: Delaware State Museums.
- 6) Victor called upon its dealers and distributors to join in the purchase of war bonds. The point was emphasized on the April 1918 cover of The Voice of the Victor.



In 1918, Victor had been called on to build the wooden wings for two US Navy "flying boats," the NC4 and F5L. The wings were assembled in the Jigging Department, using large wooden clamps. Next, they were sent in sections to the Fabric Department, where a covering similar to a pillow case was slipped over each panel. Then, a team of women hand-sewed the fabric to the frame. The panels were then sent to the Doping Department, where the fabric was painted and became skin tight. Paint fumes were so heavy, that men worked in teams of eight for only 20 minutes at a time. After adding the final toucha stenciled US Navy insignia-the oversized panels were passed through a specially-cut hole in the wall of Building #17 and lowered to the street below by pulley. From here, they were transported to the waterfront, loaded onto barges, and brought to the Philadelphia Naval Ship Yard, where they were attached to the aircraft hulls.

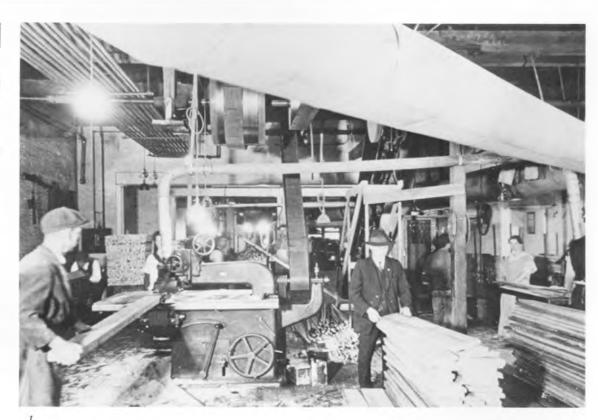








- 1) Wood sanding operations in the cabinet factory (Building #17A), where planks were rough sanded for the making of rifle stocks and airplane wings, 1918.
- 2) Airplane wing assembly operation in the Jigging Department of the cabinet factory (Building #17C). Large wooden clamps held sections of the frame in place during assembly. The wings were built for US Navy NC4 and F5L "flying boats."





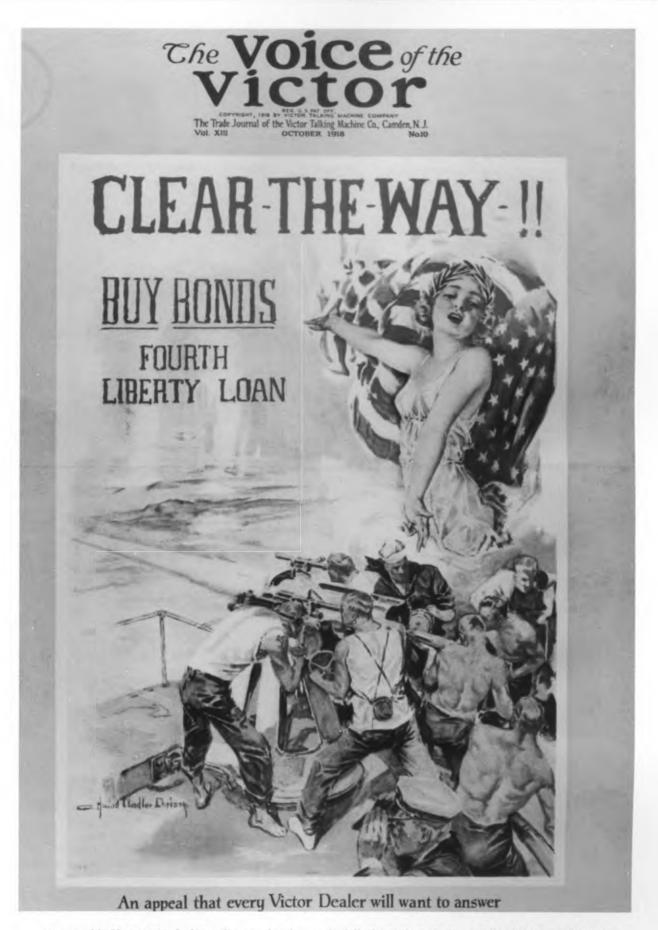


- 3) The airplane wing painting and varnishing in the Doping Department of the cabinet factory (Building #17C), 1918.
- 4) An assembled biplane wing awaiting fabric covering on the upper section. The finished wings were too large to fit through the doors, and had to be removed from the building through a hole cut in the wall. They were placed on barges and shipped to the Philadelphia Naval Ship Yard. Photos courtesy of: Delaware State Museums.





A Victrola XI helping to draw a crowd during a July 1917 recruiting rally at 42nd street and 5th Avenue, New York City.



An appeal by Victor to its dealers to buy war bonds — colorfully depicted on the cover of The Voice of the Victor.

Over fifty sets of NC4 wings were constructed by Victor during the war. The NC4 was designed to bomb German submarines in the Atlantic. Although it never saw combat action, it did cross the Atlantic in 1919, the first plane to do so.

Over 1,200 of Victor's 9,000 employees joined the armed forces during the war. Famousname Victor recording artists participated in campaigns to sell war bonds. By September 1918, even the engineers of the Building #15 recording lab were reassigned to the airplane wing assembly operation.

With the signing of the Armistice on November 11, 1918, World War I had ended. Victor began the difficult and time-consuming process of restructuring the Camden plant back to normal operations. The company had back orders for Victrolas and records of \$200 million. By March 1919, commercial production had resumed, but full capacity was not reached until October.

Plans, Programs and Policies (1912-1918)

By 1912, Victor began to concentrate on plans for improving employee welfare programs. The company assumed sponsorship of the Victor Employees Cooperative Beneficial Association in April 1913, which had, with company approval, been operated by the employees previously. Terms in 1913 included employee costs of 50¢ to join and \$3.00 in annual dues. The company matched employee contributions dollar for dollar. Benefits included \$1.00 per sick day (up to one hundred days) and \$150 in the event of death of the employee.

On April 15, 1913, the first group life insurance policy was taken out with the Traveler's Insurance Company. This new policy provided increased death benefits at no cost to employees. For members of the Beneficial Association with five or more years of service and a monthly salary of \$200 or less, the death benefit was increased to \$500. This was further increased to \$750 in 1916 and \$1250 in 1917.

The first pension plan was established on May 15, 1913. Initially, only employees with a monthly salary of \$200 or less could participate. The plan went into effect at age 65 for men and age 55 for women. After 20 years of service, the participant received a monthly payment of \$30.

In addition to these three plans, the company made further provisions for exceptional cases. Employees living outside normal commuting distance to the plant were reimbursed for travel to and from work. A plant dispensary was set up to handle accidents and illnesses during work hours.

A new license royalty plan was announced

by Victor on August 1, 1913. Whereas previous plans covered licenses to sell, this new plan provided licenses only for the use of instruments and records. Victor machines were licensed for use only with Victor records, sound boxes and needles (and vice-versa). Use of Victor products for public entertainment at a profit was prohibited. The company reserved the right to repossess its products from, as well as to cancel contracts with, dealers and distributors who failed to comply with the plan. Dealers and distributors were prohibited from shipping products abroad and announcing new record releases prior to the authorized date. By 1916, Victor had over 6,000 dealers and 100 distributors. The plan was actively administered until April 9, 1917, when a negative ruling by the US Supreme Court forced its cancellation. Thereafter, Victor lost control of its products after sale to dealers and distributors. Although this was considered to be a serious loss, the large volume established from the plan over the four-year period positioned the company for further growth in the 1920's.

Financial Summary (1912-1918)

The success of the Victor Talking Machine Company over this seven-year period can best be described with a few statistics. From 1902 to 1911 the company paid annual dividends of 6 percent on its privately-held common stock each year. In 1912, the figure jumped to 20 percent, followed by another 20 percent in 1913, 35 percent in 1914, 30 percent in 1915 and an incredible 80 percent in 1916. By 1917, Victor's commercial production was curtailed to devote its resources to war materials production. Annual dividends dropped to 50 percent in 1917 and 20 percent in 1918. By 1919, normal operations resumed and the payments were again back to 50 percent.

Between 1912 and 1918, over 127 million records and 2.5 million instruments were sold. Sales of 573,000 instruments in 1917 was the highest ever achieved in a single year by the company. The secret to success was in Victor's conservative policy of putting profit dollars back into its operations. Continuous expansion of, and improvements to, the facilities enabled the company to do a large volume with increased efficiency. The story of the phenomenal growth and success of the Victor Talking Machine Company from 1912 to 1918 was best summarized in Eldridge Johnson's own words: "The Victor Company is now in possession of many patents and secret processes, but our greatest secret process is this - WE SEEK TO IMPROVE EVERYTHING WE DO EVERY DAY."

- 1) Victor regularly sent year-end messages of goodwill and prosperity to its dealers and distributors. December issues of The Voice of the Victor carried these messages in Christmas card style, as shown here in 1916. These messages served both to thank them for a profitable year and to motivate them for the year ahead.
- 2) A typical view of the Camden plant during the Christmas season, when production lines roared well into the night. This Christmas 1916 scene shows a westward view of Cooper Street, illuminated by (1r) the metal manufacturing operations (Building #4), the record pressing operations (old Building #3), the recording and research lab (Building #15), and the general offices (Building #2).
- 3) A rare photograph of Victor officers and key staff, taken during an April 25, 1914 luncheon. Pictured (l-r) were C.K. Haddon, vicepresident and treasurer; W.J. Staats, comptroller; A.C. Middleton, secretany; A.W. Atkinson, asst. secretary; L.F. Geissler, general manager; B.G. Royal, general superintendent; E.R. Johnson, president; R.L. Freeman, asst. secretary and L.F. Douglass, chairman of the board. Courtesy: Delaware State Museums.







Camden Plant Expansion (1919-1924)

The final phase of the Camden plant expansion by Victor began in early 1920 with the addition of another Victrola cabinet manufacturing building on the waterfront property. Building #24 was erected alongside the dry kiln (#11) and was adjoined to it for quick access to the needed lumber.

Construction of an addition to the power plant began in July 1920. This new wing (Building #12A) extended off the south face of the plant. Completed in 1921, it provided the additional power needed for the growing Victor complex.

Victor's original Victrola cabinet factory (old Building #8), located on the west corner of Delaware Avenue and Cooper Street, was demolished in February 1923 to clear the way for construction of a new record pressing plant (Building #10).

Building #10 was started February 3, 1923 with the driving of hundreds of concrete piles into the filled ground on the waterfront. The massive eight-story structure was completed by the end of the year. During its construction, the neighboring record materials manufacturing plant (Building #13) was expanded from four to seven stories and the two buildings were joined. This resulted in a streamlined operation for manufacturing and pressing of Victor records. The new pressing plant was a necessary addition, since the current plant (old Building #3) on Front and Cooper Streets could no longer handle the huge demand by the diskbuying public. (The company reached an all-time high of nearly 55 million record sales in 1921).

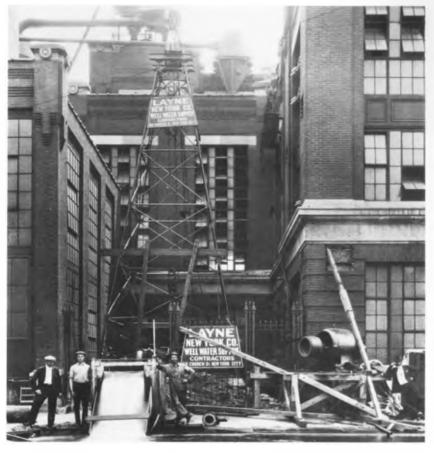
No longer needed, the record pressing plant (old #3) on Front and Cooper Streets was demolished in May-June 1924 to provide space for a new, ten-story metal manufacturing building (Building #8). Begun in August 1924, Building #8 was to be the last new construction at the Camden plant by Victor. The towering structure, joined with Building #4 to the east and #18A to the south, was completed in February 1925. Victor now had a very efficient metal manufacturing operation housed within a single complex consisting of Buildings #8, #4, #18 and #18A. This complex was joined to both the cabinet factory and shipping department via overhead bridges from #18A. This upgrade to the metal manufacturing operation in 1925 was very timely. That same year, Victor introduced its first orthophonic and

electronic Victrolas, which necessitated additional floor space to assemble both the manual (spring) and automatic (electric) motors.

The only other significant alteration to the Camden plant by Victor was the demolition of several row houses on company-owned property surrounding the general office building (#2). Several abandoned buildings on the northwest corner of Cooper and Point Streets (#37 to #49 Cooper Street) were razed in June 1924. Eleven more row houses on Point Street (north side, behind Building #2) were torn down in September. These two cleared areas were to become the site of the

1) The last new construction in Camden for Victrola cabinet manufacturing began in February 1920. This extension to the dry kiln was known as Building #24.





final addition to the Camden plant. Following the acquisition of the Victor Talking Machine Company in 1929 by the Radio Corporation of America, a new radio manufacturing facility, a dispensary and employee cafeteria were built on this site. Adjoined to both the west and north faces of Building #2, this new facility (Building #3) extended west to Delaware Avenue and north to Penn Street. The section of Point Street between Penn and Cooper Streets was eliminated. Completed in 1930, Building #3 was the one and only addition to the Camden plant by the Radio Corporation of America.

- 2) New well water drilling on the eastern end of the power plant, 1922.
- 3) An aerial view of the Victor facilities in Camden, January 1922.

2







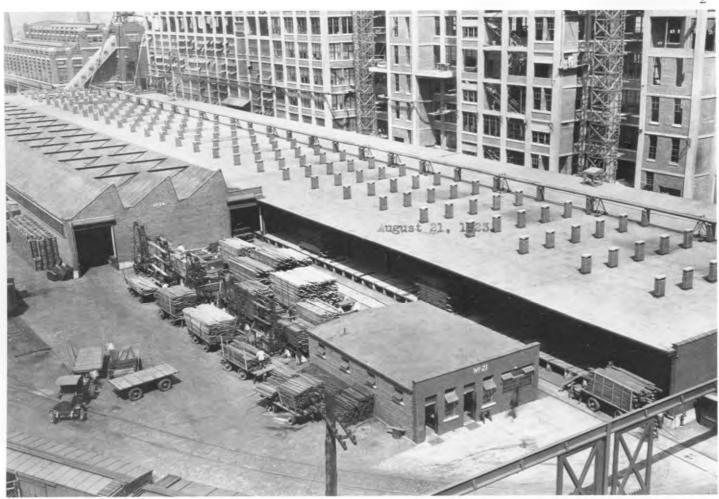
- 1) Eastward view of the site for the new record pressing plant (Building #10), March 1923. The original Victor cabinet factory (old Building #8) was demolished to make way for the massive plant addition.
- 2) Westward view of the record pressing plant construction site, March 1923. Note the four-story record materials manufacturing plant (Building #13), which was enlarged to seven stories and connected to the new, eight-story pressing plant.



Progress on Buildings #10 and #13, June 1923, shown here on the July cover of The Voice of the Victor.



- 1) View northeast from the wharf yard, showing the ongoing construction of Building #10 (left) and the Esterbrook Pen Company factory on the corner of Delaware Avenue and Cooper Street, August 21, 1923.
- 2) Northwest view of the wharf yard, showing (l-r) the last addition for cabinet manufacturing (#24), the adjoining chimney-dotted dry kiln (#11), and the yard office (#21). In the background, construction of #10 and #13 continues.





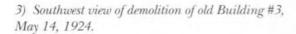
The completion of Building #10 and #13 was proudly announced to dealers in the February 1924 issue of The Voice of the Victor.

- 1) A Victor gate guard controlled vehicle access to the alley between the old record pressing plant (old Building #3, on the left) and the metal manufacturing plant (Building #18A). Looking east, across Front Street, 1923.
- 2) Beyond the newly-installed fountain in Johnson Park stood the six-story metal manufacturing building (#4) and the five-story record pressing plant (old #3) on June 8, 1923. The fountain was yet another gift made by Eldridge Johnson to the City of Camden. Looking south, from the steps of the Cooper Branch Free Public Library.









- 4) Looking southeast from the steps of the Victor office building (#2), on May 29, 1924, demolition of old Building #3 is nearly complete.
- 5) Southwest view on June 18, 1924, showing cleared site for new Building #8.









- 1) Eastward view of the construction site for Building #8, July 16, 1924.
- 2) Southeast view on September 9, showing four stories framed.



- 3) Same view on September 24, with seven stories framed.
- 4) Building #8, nearing completion on December 31, 1924. The building was finished in February, 1925. In this photo, Building #4 is seen on the left and Building #18A is on the right.



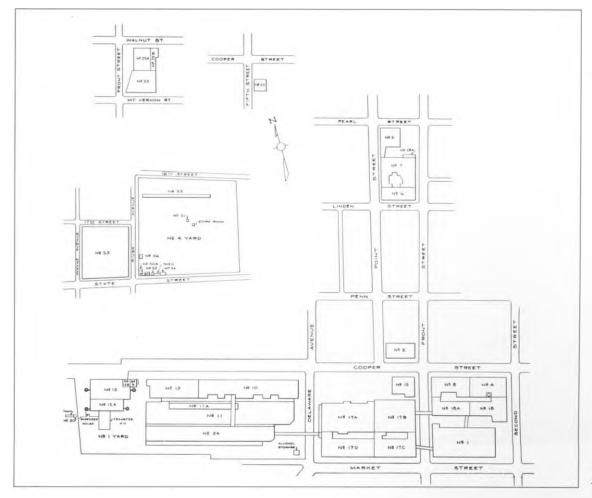
- 1) Demolition of seven Victor-owned buildings (#37 - #49 Cooper Street) underway, June 11, 1924. This northeast view shows the office building (#2) on the corner of Cooper and Point Streets.
- 2) Demolition of buildings on Cooper Street complete, June 25, 1924. Note the rowhouses on Point Street adjacent to Building #2. These were also razed later that year.







3) Northeast view of Point Street, from the corner of Cooper Street, September 9, 1924. These eleven row houses adjacent to Building #2 were demolished later that month.



4) Property locations of the Victor Talking Machine Company, Camden, NJ in 1929.

Recording Activities and Product Developments (1919-1924)

Following World War I, the Victor Talking Machine Company was able to return to normal operations. Victrola sales rose from 315,624 units in 1918 to 474,602 in 1919. Sales of 21,547,047 records in 1918 jumped to 30,851,527 the following year. Recording activities also resumed, with the addition of several prominent artists to the Victor catalog.

On October 9, 1919, the Vatican Choir, directed by Raffaele Casimiri, recorded for Victor at the Trinity Church studio in Camden. The first Victor records of Paul Whiteman and His Ambassador Dance Orchestra were made on August 9, 1920. Whiteman's unique style, exemplified in his first two selections for Victor ("Avalon" and "Whispering") made him the top name in dance records.

Another milestone recording event occurred on December 17, 1920, when the La Scala Orchestra of Milan, Italy recorded at the Camden studio under the direction of Arturo Toscanini.

Enrico Caruso made his last records for Victor (in Camden) on September 16, 1920. His last recording was "Messe Solonelle" (The Crucifix") by Rossini. Two months later, while performing at the Met, Caruso became ill. He returned to Naples, Italy in April 1921 after his condition worsened. The Great Tenor died on August 2, 1921 at the age of 47. Often quoted as saying "My Victor records shall be my biography," Caruso had indeed been immortalized through the achievements in recorded sound. At the time of his death, his royalties totaled \$2 million.

Another notable artist who signed with Victor during this period was Sergei Rachmaninoff, the great Russian-born composer, pianist and conductor, whose concertos remain among the most-performed around the world today. He signed with Victor in 1920. The first Victor piano concerto recording, made on December 31, 1923, was with Rachmaninoff. He was joined by the Philadelphia Symphony Orchestra under the direction of Leopold Stokowski.

Italian tenor Beniamino Gigli first recorded for Victor on January 5, 1921. Italian baritone Mattia Battistini was recorded by Victor engineer Raymond Sooy in Milan, Italy on May 21, 1921. Soprano Maria Jaritza made her first Victor record on March 7, 1922. President Warren Harding made a recording at the White House on May 24, 1922 of an address he gave



1) Arturo Toscanini on the January 1921 cover of The Voice of the Victor. Toscanini conducted his first orchestra for a Victor recording in Camden on December 17, 1920 (La Scala Orchestra of Milan, Italy). Only a few months earlier Caruso made the last recording of his career, also in Camden. Toscanini is second only to Caruso as the most renowned Victor artist. He went on to become conductor of the NBC Symphony Orchestra in 1937.



2) Italian baritone Mattia Battistini (1856-1928) never came to America, due to his fear of sailing the ocean. He was recorded by Victor engineer Raymond Sooy in Milan, May 1921.

3) A September 1919 Victor advertisement highlights both its best artists and the ornate "Victrola XVII." Courtesy: Neil Maken, Yesterday Once Again.

the day before in Hoboken, NJ. Actor Will Rogers was first recorded by Victor on February 12, 1923. Russian-born bass singer Feodor Chaliapin held his first Victor session on January 3, 1924.



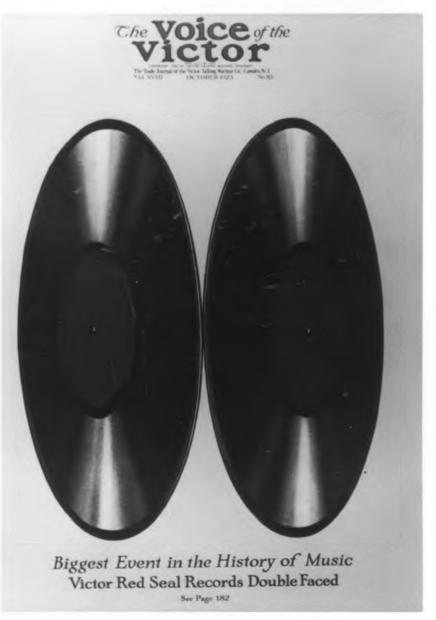


On June 1, 1923, Josef Pasternack resigned as musical director of Victor and was succeeded by Rosario Bourdon. Calvin G. Child, who had served as manager of both the Recording Laboratory and the Artist Repertoire Department at Victor, resigned on October 1, 1923.

Victor's New York recording studio moved again on January 6, 1921, from 46 W. 38th Street to 28 W. 44th Street. The first "flat top" Victrolas were introduced by Victor in 1921, reacting to a popular competing model by Brunswick and Sonora. Nearly 600,000 flat top Victrolas were produced through 1926. These horizontally-styled cabinets were Eldridge Johnson's response to dealers' pleas for a more modern design. The competition had been offering this style for almost four years before Victor reacted. Despite this new product's introduction, Victor's total instrument sales plummeted from 560,062 in 1920 to 320,860 in 1921. Several flat top variants were introduced by Victor between 1922 and 1923, which helped the company to recover lost market share. Total instrument sales increased to 384,105 in 1922, 403,580 in 1923 and 411.009 in 1924.

Victor record sales of 54,920,855 in 1921 were the highest in the company's 28-year history. The figure dropped to 37,162,717 in 1922, then increased to 40,542,480 the following year. This minor recovery was due to the introduction, on September 21, 1923, of the first double-sided "Red Seal" records.





GET ON THE "FRONT COVER" OF YOUR TOWN



- Evolution of Victor's Model XVI Original
 ENCLOSED HORN 1906
 TALKING MACHINE

 1912

 * STYLED BY POOLEY, THE VENDOR

 # THIS AND SUBSEQUENT MODELS STYLED BY W.B. STEVENSON OF VICTOR'S STAFF

 MODEL NO. 111 IS SHOWN HERE INSTEAD OF NO.120 (MODEL XVI UNDER A NEW NUMBER CODE) AS MORE REPRESENTATIVE OF THE STYLING TREND
- 1) This February 1921 Victor ad for Caruso was published in The Ladies' Home Journal shortly after the tenor became seriously ill. Caruso died six months later. Courtesy: Larry Peterson, GE GCSD.
- 2) One of the first "flat top" Victor Victrolas was the popular Victrola model No. 230, announced to dealers in November, 1922.
- 3) Double -faced Victor "Red Seal" records were introduced on September 21, 1923 and advertised with great fanfare in the October issue of The Voice of the Victor.
- 4) This 4'x 5' steel sign was a familiar sight in storefront windows across the United States in the early 1920's. Victor offered the design to its dealers for \$5.35 in this May 26, 1922 announcement.
- 5) The Victor Victrola XVI evolved from a simple design produced by an outsourced cabinet builder in 1906 to a stylish, hand-carved work of art eighteen years later.
- 6) Victor advertised and produced custom-built Victrolas periodically throughout the 1910's and 1920's. At the time of this publication (1924), the company employed over 125 wood carvers, who specialized in handcrafted cabinet building.

5



We build Victrolas to order

To those who desire a Victiola of special design to harmonize with the furnishings of any particular room, we extend an invitation to make use of the services of the Victor Art Shop. We are prepared to furnish an instrument of Victor quality embodying your own individual requirements. Let us know your needs and we will gladly submit sketches and upon approval complete for you an instrument conforming to the exacting Victor standards. Consult any dealer in Victor products or write to us direct.



August, 1924

Every big event in music is a reason for having a Victrola

Each season in succession new artists create a sensation through their portrayal of famous operatic characters and old favorites add to their multitude of admirers through their achievement of still greater artistic accomplishment. In the season just closed outstanding features were the performances of Victor artists. So it is year after year and has been for two decades. So it will be next year.

Victrola Instruments are made especially to reproduce the marvelous variety of Victor Records by the world's greatest artists, in twenty-one styles at from \$25 up-all identified

by the Victor name and trade marks.



CARUSO Victor Artist



GALLI-CURCI Victor Artist



KREISLER Victor Artist

HIS MASTER'S VOICE"

"My Victor Records shall be my biography" said Caruso in an interview published some time before his death. The statement was made during the close association with the Victor Company, which existed throughout the great tenor's artistic life. The Victor Records by Caruso constitute a library of living music without parallel in the history of the art. Hear these and you will want to hear all:

	Double-faced
O sole mio 'A Vucchella	} 501 \$1.50
Le Cid-O souverain, o juge, o père! La Juive-Rachel! quand du Seigneur	6013 2.00
Dreams of Long Ago Love Me or Not	6015 2.00

Before Galli-Curci had sung a note to any American audience the Victor laboratories in Camden had caught imperishable records of the voice with which she was so soon to conquer another continent. How well our faith in her was justified, how well the public's judgment was founded—these things are attested again by such records as these:

	Double-faced
Dinorah—Ombra leggiera Lucia—Mad Scene	6129 \$2.00
Lakmé-Dov'è l'Indiana bruna Solvejg's Song	6132 2.00
La Capinera Caro mio ben	629 1.50

Possession of any Victor Record by Kreisler is possession of a masterpiece. There is little in violin music that he has not explored, humanized, enriched with his own knowledge, and recorded for the Victor Company. On many of his Victor Records, he plays his own compositions. Choose for yourself, but in your choosing be sure you hear these:

	Double-faced
Liebesfreud Liebesleid	6182 52.00
Dream of Youth Forsaken	708 1.50
The Old Refrain The Rosary	720 1.50



Victrola No. 50 (Porrable)





There is but one Victrola and that is made by the Victor Company—look for these Victor trade marks

Victrola

Victor Talking Machine Company, Camden, N. J.

An August 1924 advertisement of Caruso, soprano Amelita Galli-Curci, violinist Fritz Kreisler, and three different styles of Victrolas: a portable (No. 50), an upright cabinet (No. 80) and a flat top cabinet (No. 215). Courtesy: Neil Maken, Yesterday Once Again.



MARTINELLI



BORI Victor Artist



DE LUCA Victor Artist

The forty-three records by Martinelli listed in the Victor Record catalog are the authentic interpretations of this great tenor. They are Martinelli himself-every record carries with it his own personal approval. His selections include:

	Double-faced	
Eugene Onegin-Air di Lenski L'Ultima Canzone	} 6195	\$2.00
Ernani—Come rugiada al cespite Iris—Apri la tua finestra	} 737	1.50
William Tell—O muta asil del pianto Traviata—Dei miei bollenti spiriti	6212	2.00

There's a charm to Bori's every interpretation that is most delightful, and it is depicted with absolute fidelity on Victor Records. This life-like quality is readily apparent to the artist herself-to every one upon hearing any of her twenty-five records. Among them are:

	Double-faced	
Traviata-Addio del passato Don Giovanni-Vedrai, carino	} 543	\$1.50
Malagueña Clavelitos	} 544	1.50

Whatever De Luca sings, his performance is perfection itself and he finds every self-same quality reflected in his Victor Records. Thirty-one numbers have been recorded to date. Here are some of them:

	Double-faced	
Barbiere di Siviglia-Largo al Factotum Ernani-O de' verd' anni miei	6077	\$2.00
William Tell-Resta immobile Marriage of Figaro-Se vuol ballare?	596	1.50
Don Carlos-Per me giunto Masked Ball-Eri tu	} 6078	2.00



Victrola No. 111 \$225 Electric, \$265 Mahogany or walnut





The Victor Company originated the and remember that the Victrola-the modern talking machine and was the standard by which all are judged-costs no more. The Victrola instrument line first to offer the public high-class music by great artists. Victor Supremacy began includes twenty-one models of the three then. It has been maintained by the general types shown at from \$25 up. continuing patronage of the world's greatest musicians and by the merit of Ask your dealer or write to us for illustrated catalog. Victor Products.

To be sure of Victor Products, see the following trade-marks-under the lid of every instrument and on the label of every record.

HIS MASTER'S VOICE"

In buying a talking machine, consider

that you must choose the Victrola or

something you hope will do as well,

ctrol

Look under the lid and on the labels for these Victor trade-marks Victor Talking Machine Company, camden, N.J.

Other Business Activities (1919-1924)

In an effort to further promote product sales, Victor established a sales school at the Camden plant in 1919. Generally known as the "Red Seal School," its main purpose was to promote sales of "Red Seal" records. Two-week classes were conducted for dealers and distributors. The classes were free of charge. Only travel and living expenses were paid by the students. The classes, held in the Victor office building (#2), covered the basics of salesmanship, store management, and orders. The school was a big success, resulting in a significant increase in record and instrument sales through the early 1920's.

The Traveling Department consisted of 29 regional managers by 1920, who covered dealer territory from coast-to-coast. H.A. Beach, manager of the Traveling Department, organized annual conferences in Camden to update his representatives on new product and operational developments.

The talking machine industry suffered a serious financial blow in 1919. The US Government rated musical instruments as semi-luxury items after World War I ended. In addition to the general excise tax of 3 percent, Victor and its competitors had to pay a special 5 percent excise tax. This new law resulted in Victor's payment of almost \$4 million in taxes in 1920.

By 1919, Eldridge Johnson's active participation in Victor business affairs had become minimal due to health reasons. That year, he moved his home from Merion, Pennsylvania to Moorestown, New Jersey. His philanthropic deeds, beginning with a \$65,000 donation for the start of the Cooper Branch Free Public Library, continued for many years. Johnson, in fact, donated nearly \$400,000 to the City of Camden between 1916 and 1931 just for the Camden Library system. The majority went to the Cooper Branch at Front and Cooper Streets. Besides the \$200,000 Johnson paid for the construction of the

- 1) Company letterhead, October 1920.
- 2) The Victor Statistical Department, posing for a group photo on the steps of the Cooper Branch Library, early 1920's.
- 3) The October 1920 issue of The Voice of the Victor featured the company's Traveling Department.
- 4) The 29 members of the Victor Traveling Department posed for this group photo in front of the general offices (Building #2) at the conclusion of its annual conference in Camden, September 3, 1920.



Victor Talking Machine Company

CABLE ADDRESS

CAMDEN, N.J., U.S.A.

October 1, 1920.

Miss Katherine Dugan,



building itself, he also bought numerous books and a piano for the library and the fountains, bronze statues and railings for the surrounding park. The famous "Peter Pan" statue, still situated at the head of the fountains today, was brought back from England by Johnson in 1924 and donated to the city for the park. Its value was \$12,278 at the time.

The park surrounding the Cooper Branch Library was also donated by Johnson in December 1921. The City of Camden changed the name from Cooper Park to Johnson Park in his honor.

Johnson also made regular contributions to a variety of other local Camden activities throughout the 1920's. The list included the Camden County Historical Society, Park Association, Park Police, Red Cross, YMCA and the Chamber of Commerce.

The company increased its assets significantly during the early 1920's. On December 5, 1920, Victor purchased half interest in the Gramophone Company, Ltd. for \$1.6 million. Another \$1.6 million was invested in 1921 to establish the Pan American Recording Company in Argentina. In 1923, Victor's domestic growth included the addition of two buildings at the Camden plant (#8 and #10) and the purchase of twenty acres in Oakland, CA, where a west coast manufacturing building was constructed. Finally, for \$5.1 million, Victor purchased a controlling interest in the Berliner Gramophone Company of Montreal. The name was changed to the Victor Talking Machine Company of Canada, Ltd.





Radio: The New Threat to Victor

By 1924, however, the business situation for Victor had worsened. For the first time in the company's history, sales were flat. In fact, the entire talking machine industry was losing money, due to the arrival of a new form of entertainment in America—radio.

Radio receivers were evolving from simple curiosities for amateurs to manufactured products for the consumer by 1921-22. Victor, meanwhile, was enjoying tremendous sales of Victrolas from 1920 to 1923 and had not taken action to prepare for this new threat.

In 1924, the Radio Corporation of America (RCA) introduced a product line which took the buying public by storm. Models like the Radiola III, the Super VIII, the Regenoflex and a semi-portable superheterodyne were replacing Victrolas in many homes. The public saw two big advantages of radio. First it was electronic, whereas the Victrola was a mechanical instrument. Second, musical entertainment was free with a radio. With a Victrola, records had to be purchased. Victor closed the year with heavy inventories—at dealers, distributors and at the Camden plant.

In 1924, Victor was managed by a committee consisting of Edward Shumaker, Walter Staats and E.R. Fenimore Johnson (son of Eldridge). They took a number of steps to turn the company around and regain market share.

On January 1, 1925, Victor sponsored its first radio broadcast. The program, carried

over a 14-station network, featured John McCormack and Lucrezia Bori. This event marked the beginning of the alliance between Victor and radio.

A contract was signed with RCA for the manufacture of radio receivers for insertion into Victrola cabinets. This event set the stage for RCA's purchase of the Camden plant four years later.

The Advent of Electrical Recording

Meanwhile, a major breakthrough in the sound recording and reproduction industry was introduced by Messrs. Maxfield and Harrison of the Bell Telephone Laboratories. Working through the Western Electric Company, they had discovered a process for both electrical recording and electrical/acoustical playback. The process was discovered by applying laws of wave propagation of electrical energy to mechanical energy. In 1924, Western Electric offered a patent license to Victor. A licensing contract was signed in December 1924 and, by February 1925, Victor's Camden lab had been upgraded with electrical recording equipment. On March 11, the first formal Victor electrical recording session was held in Camden. The New York lab followed with its first electrical recording session on July 31, 1925. The first commercial Victor record under the new electrical process was an excerpt of the University of Pennsylvania's Mask and Wig Club, released in April 1925.

- 1) Rosario Bourdon, leading the Victor Orchestra for an electrical recording session in Building #15 in 1925. Bourdon succeeded Josef Pasternack as musical director for Victor on June 1, 1923. The recording lab was upgraded with the revolutionary electrical sound recording equipment in February 1925.
- 2) This October 21. 1925 RCA ad highlighted the Radiola #25 (top photo) which was manufactured for Victor Victrola #9-1 and #7-2. The Radiola #28 (lower left) was used in Victrola #9-3, #9-15 and Electrola #9-55. The Radiola #20 (lower right) was used in Victrola #7-3 and #7-30. All three Radiolas were built for Victor beginning in 1926.



82 THE SATURDAY EVENING POST October 31, 1925 RADIO CORPORATION OF AMERICA NEW YORK CHICAGO SAN FRANCISCO

Product Developments (1925-1929)

With the arrival of electrical recording and the commercially-produced radio receiver, the Victor Talking Machine Company spent its last four years in a variety of noteworthy activities.

The company had signed contracts with both Western Electric and the Radio Corporation of America, setting the stage for an entirely new instrument line. The contract with Western Electric also included rights to manufacture and sell the patented "re-entrant" orthophonic acoustic horn. This new improvement to acoustical playback was incorporated into the new Victor "Orthophonic Victrola." A first production run of 10,000 was ordered.

By 1925, Victor records were being produced through the electrical recording process, using a microphone in place of the acoustical horn. These orthophonic records were also an immediate success.

A decision was made to liquidate the existing inventory both at the Camden plant and at Victor's dealers and distributors. By mid-1925. Victrola production lines were brought to a halt and a heavy sales campaign started. A \$5 million advertising budget, the largest ever by Victor in a single year, was set up. Lloyd Egner, manager of the Victor Traveling Department, organized the effort. He appointed district managers to a dozen major cities across the country. Every qualified Camden employee was sent to the "field" to sell. Roy Forbes was appointed Sales Manager. The company's advertising account was switched from F. Wallis Armstrong to N.W. Ayer & Company. The campaign was a success, as evidenced by almost \$1 million in sales that year.

In June 1925, the company announced its plans for production of the new Orthophonic Victrolas to its dealers and requested them to liquidate their inventories to make room for the new models. The old product lines were immediately reduced to half-price at a loss to the dealers. On September 10, four new acoustic orthophonic models were announced to distributors: the "Consolette," "Colony," "Granada" and "Credenza."

By October 1925, public advertisements began to appear around the country, hinting of an upcoming, history-making event. The publicity and suspense continued to build. The Orthophonic Victrolas were unveiled on "Victor Day," November 2, 1925. Dealers from coast-to-coast staged thousands of

NEWS

of interest to every man and woman in America

NEXT MONDAY, November 2nd

THE most astonishing demonstration ever held will be given throughout the country by dealers in Victor products. It will begin at 9 A. M. and continue throughout the day

It will introduce the most important contribution to music since the invention, 30 years ago, of the Victor Talking Machine

Don't miss it! It will be one of the most amazing demonstrations you have ever heard. It will establish new standards of comparison and change your whole present viewpoint on the subject of music in the home.

The more critical your attitude toward muss, the more arounded you will be. You will hear a range of tone, a perfection of tone, a richness and fullness in every note that will move you to the edge of your chair with an eagerness hitherto unknown.

A few people have heard this new instrument, and to say that they have been amazed, is but a meager description. Fritz Kreisler, Ernestine Schumann-Heink and John Philip Sousa have listened and marveled.

November and has been set aside as Victor Day—as the day on which this new instrument will be presented to the public. All classes of music will be played and sung by Victor's own incomparable artists. Instrumental solos. Vocal selections. Choruses. Banda. Dance music. In sufficient variety to disclose the amazing venatility of the instrument.

No matter what you plan to do next Monday, do not well this demonstration. You will never forget it

Go to the nearest dealer in Victor products any time after nine oclock during the day of November and. Even though you may be away from home, there will be a demonstration nearby which you can attend in every city, in every state in the United States, this miraculous instrument wall amaze and capture all who hear it.

States, this miraculous instrument will amate and capture all who hear it.

Victor Day—November 1, 1925—ii destined to be a day that will stand out in the history of music.

The New Orthophonic



Victor Talking Machine Company, Camden, New Jersey

7

demonstrations of the new models. Dealers were sold out within a matter of days.

On December 16, 1925, Victor announced eight more models, including two "Electrolas" (electrical amplification), four acoustical "Victrola/Radiola" combinations, one electrical "Victrola/Radiola" combination and one electrical/acoustical "Victrola/Radiola" combination. A total of 19 models were introduced in 1925, followed by 24 more in 1926. Prices ranged from \$17.50 to \$1000.

1) The company launched a nationwide advertising campaign in 1925 for the new Orthophonic Victrolas. This ad, published the week before the official unveiling, is another example of Victor's effective technique in creating curiosity and suspense.



Warm wishes for a Happy New Year were presented to Victor dealers on the cover of the December 1925 issue of The Voice of the Victor. The new Orthophonic Victrola Credenza highlights this ornately-decorated parlor.

By the end of 1926, the first full year of Victor's new product line, the loss of \$6.5 million in 1925 was fully recovered. Sales of 262,274 instruments in 1925 jumped to 419,004 in 1926. Record sales increased from 25,171,604 in 1925 to 31,873,620 in 1926. Having formed an alliance with the Radio Corporation of America, Victor began production of Victrola/Radiola combinations in both Orthophonic (acoustic) and Electrola versions.

The first Radiolas to appear in Victrolas were the Radiola #25 (in VV #9-1 and #7-2), Radiola #28 (in VV #9-3 and #9-15) and Radiola #20 (in VV #7-3) in 1926.

In 1927, RCA Radiolas #20 and #28 were produced for two new orthophonic models (VV #7-30 and #9-55, respectively). The Radiola #16 and #17 were built for the VV #7-10 and #7-25, respectively, and the Radiola #20 was introduced as the first Victor stand-alone Radiola (#R-20).

The RCA Radiola #18 and #64 were first manufactured for Victor in 1928. The Radiola #18 was included in models VV #7-11 and VE #9-16. The Radiola #64 was contained in the VE #9-18, #9-54 and #9-56.

The first luggage-style portable Orthophonic Victrolas were unveiled in 1926. The VV #1-5 weighed 16 pounds and cost \$35. The VV #1-6 was 13 pounds and \$25. These were followed by the VV #2-30 in 1927 and the #2-35 and #2-55 in 1928.

Another milestone achievement by Victor was introduced in March 1927-the first phonograph with an automatic record changer. New models of Orthophonic Victrolas, Electrolas and Victrola/Radiola combinations continued to roll off the Camden production lines for the next several years.

These significant advancements resulted in four consecutive years of Victrola sales which were among the best in the company's history. Instruments sales of 262,274 in 1925 jumped to over 400,000 each year between 1926 and 1928. In 1929, the year of the acquisition of Victor by RCA, 533,283 Victrolas were sold.

Victor's total instrument sales between 1925 and 1929 included 735,244 Orthophonic Victrolas, 38,199 Electrolas and 217,064 Victrola/Radiola combinations. The company also sold 166,929,006 records in that five-year period.

The Victor Talking Machine Company had demonstrated to America that radio was not going to replace recorded sound!

THE **VOICE OF THE VICTOR**



THOSE WHO KNOW AND WANT THE BETTER THINGS OF LIFE-THE NEW ORTHOPHONIC VICTROLA

IN THIS ISSUE:

A Camping-Place for the Night A Truck-Driver's Story The Range of the Big Gun What Engineers Say

Vol. XXII No. 2

Children of Ignorance Facing the Music

and other interesting features

February, 1927



Victor presents the ultimate

in combination instruments

HERE, beyond the shadow of a doubt, is the most comprehensive medium of home-meterainment in the world . . the wonderful new Orthophonic Victrola and the latest Radiola, combined in one beautiful cabinet, with models so meet every taste and purse; with models so meet every taste and purse;

Not alone the finest talking machine and the finest radio in one, but radio that can be head in no other way. For reception is through the famous Orthophonic Tone-Chamber. This means tones so natural, so lifelike, that no imagination is needed to pictore the living artist standing beside the instrument.

No better investment in home-entertainment can be made. The mythical power of Aladdin is yours in very truth with these combination instruments. At will you can summon the foremost talent of the world to sing or play for you and your friends. Music of your own choosing. All the encores you wish.

The production facilities of the Victor organization have been taxed to the utmost to supply radio combinations in sufficient number. To avoid disappointment, see your nearest Victor dealer at once. You will be astounded by the performance of this greatest of all home-entersions.

Victor Artists Am Boundeastint

Sareday, Jamusy 10, Jogan the hy-weekly broadcasting of the graven array of missical taken even accentible on one program. Get your Victoria with Refinite new and hear three marrelcoas programs as they should be heard—namely, with the same flawbein realism of the acrosal concert in that tradici.

One of these superh instruments can be installed in your home.



A Very Popular Model

Ordaphenic Victoria and Radiolo Number State there. List Price, \$175. Simi-wall type adopt in Spanish style, finished in malegans, commed, blended finish

Rareries operating Radiota in special compartment accessible from from of cebeut. Complete an Radioteons furnished. Lever operated control salve permitting instantantions change from Crebophonic Victoria music to radio nelegation. Controls for positive hartery control. Outdoor or indoor antenna, with ground. Separate fide for Victoria. sed Radiola compartments. Spring or electric motor, speed indicators and regulation. (Electric motor Sy; additional.) Record maps automatically with ...Victrola with Radiola

The World's Most Comprehensive Musical Instrument

Ordeplane Vanuls—Ordeplane Element and Radiale, America Son (For, Late, Pers, From Contentions, Varride and Ordenplane, Elements of the Radiale Open-Princepolar, Elements or the Radiale Open-Princepolar, Elements of the Radiale Open-Princepolar, Elements of the Radiale Open-Princepolar, Elements of the Radiale Open-Princepolar Variation of the Princepolar Content of the Princepolar Content of the Princepolar Content of the Princepolar Content of Debtsphase Plantini, Radiale com-Princepolar Content of Contention of

> Mar and its on the Orthophesis Victoria and Radiala Number Nine-Africa. List polis, \$500.

The Electrola - Music from Records with Great Range of Volume

Where strong, clear muss in detect—it have discore, in executation, concern halls, out, the Yearn Bitarrile as the following terrorisms. The rollines of music may be registered from a whiteper to full band estimate. Caloiser naturalizary—instrond, Handed Janish. Operate from chierro-light socker, no basteries needed. Golanes can be regished to an in Eq. Bill or multi-roum. It is a bost extractable band-speaker for an subspicious can be a just passed for an independent radio too. If thereof. Just provided for





Orthophonic Victrola with Radiola

- 1) A revamped cover of The Voice of the Victor in February 1927, depicting the style and elegance of the Orthophonic Victrola Credenza (now titled model #8-30).
- 2) The top-of-the-line offering in Victor's 1927 product catalog was the VE #9-55. List priced at \$1550, this magnificent instrument embodied all the newest features in a single ornately-styled cabinet. It had an automatic record changer, it was electrically amplified (Electrola) and it had a radio (Radiola #28). The cabinet was hand-carved walnut, styled in Italian Renaissance. The Company sold 2,046 of them through 1930.
- 3) The February 1927 issue of The Voice of the Victor described (l-r) the Orthophonic Victrola #7-3 (with RCA Radiola #20), the Electrola #12-25 and the Electrola #9-40 (with RCA Radiola #28). These models listed for \$375, \$625 and \$1000, respectively.
- 4) The Portable Victrola #2-35, introduced in 1928, measured 7" high x 16.5" wide x 14.5" deep and weighed 23 pounds. Nearly 75,000 were produced at the price of \$25 each.



PORTABLE VICTROLA Number Two-Thirty-Fire List Price—\$25.00



ORTHOPHONIC VICTROLA ORTHOPHONIC ELECTROLA

Number Eight-Sixty

List Price-\$650.00

NOT only the unrivalled qualities of the full Orthophonic reproducing system in its highest development, but the power and exactness of control which distinguish the Electrola, are combined in this magnificent instrument. Acoustic reproduction for general use; Electrola, with its tremendous volume, for dancing, outdoor use and special occasions; its delicacy for the fireside hour. A cabinet of outstanding beauty and dignity—the Credenza. Equipment details on page 20.

ELECTROLA Number Twelve-One

List Price-\$250.00

To behold this instrument is to recognize the true meaning of the "elegance of simplicity." Slender, light and graceful lines in the Jacobean manner mark the wall-type cabinet. A purely electrical instrument, operated from household current supply; no batteries required. Full range of volume up to that of symphony orchestra. A loud-speaker of exceptional power and efficiency when connected to an external radio set. Equipment details on page 20.





ELECTROLA

Number Twelve-Twenty-Five

List Price-\$625.00

YOUR eyes will linger delightedly on this lovely Italian-style cabinet, with its exquisite carving, banding and panelling, its flowing lines and matched mahogany decorations. Within, it discloses an Electrola of tremendous range and power, yet easily controlled at a touch. It can be used as a loud-speaker for a separate radio receiver, and gives astonishing beauty and power to radio reception. Operated on ordinary household current supply; no batteries required. Equipment details on page 20.

Page Seventeen

Three electrically-amplified (Electrola) models, announced in a September 1927 catalog, were powered by household current. The #VE 8-60 debuted in 1926. Over 3,000 were produced. The #VE 12-1 first appeared in 1926. Over 6,000 were made. The #VE 12-25 was introduced in 1927. Over 2,000 were built.



ELECTROLA RADIOLA

Number Fifteen-One

List Price-\$900.00

ONE of the most beautiful instruments ever developed in the Victor cabinet shops. Radically different in style and treatment, strictly modern, yet characterized by uncring good taste. The conspicuous beauty of the exterior is justified by the performance of the instrument itself. Here the great power, volume and exactness of control typical of the Electrola are applied to recorded music, and to radio reception as well. The peerless Radiola Super-Heterodyne is united with the Electrola, and both are operated from ordinary household current supply; no batteries required. Equipment details on page 20.



Page Eighteen

ORTHOPHONIC VICTROLA RADIOLA

Number Nine-Fifteen

List Prices—Spring Motor \$600.00 Induction Disc Electric Motor \$635.00 Universal Electric Motor \$655.00

ONLY the Orthophonic principle of sound reproduction, (employed exclusively in Victorinstruments) together with the Radiola Super-Heterodyne, finest of radio receivers, can achieve the magnificent qualities that mark the performance of the Number Nine-Fifteen. These two epoch-making instruments are here combined in a cabinet of rare beauty, expressing the spirit of the Italian master builders of long ago, together with what is best in the modern trend of cabinet design.

The same style instrument illustrated and described above may be had combined with a six-tube Radiola Super-Heterodyne.

Number Nine-One

List Prices Spring Motor \$475.00 Induction Disc Electric Motor \$510.00 Universal Electric Motor \$530.00



THE RADIOLA

R-Twenty

List Price-\$135.00

THE ever popular Radiola Twenty in a cabinet of Victor design Complete with loud speaker unit, and Victor amplifying system. Space for batteries in compartment accessible from front of cabinet.

The #VV 9-15 was first introduced in 1926 and included a Radiola #28. Over 2,500 were produced. The #VE 15-1 debuted in 1926 and also had a Radiola #28. The #R-20, first produced in 1927, was the first stand-alone Radiola offered by Victor. RCA built the Radiola (#20) and Victor built the cabinet and assembled the final product. Over 6,000 were produced.

Recording Activities (1925-1929)

The final years of the Victor Talking Machine Company were marked by numerous achievements in sound recording.

On June 10, 1926, the company made the first live recording of the Philadelphia Symphony Orchestra at the Academy of Music in Philadelphia. Before then, all orchestral recordings were made at the Camden studios. This first live session was so successful, all subsequent recordings of the Philadelphia Symphony Orchestra were made at the Academy of Music. Live recordings were next made of the New York Philharmonic Orchestra at Carnegie Hall, New York City; the Chicago Symphony Orchestra Hall, Chicago; the Hollywood Bowl Symphony Orchestra, Hollywood Bowl, California (outdoors); and the Boston Symphony Orchestra, Symphony Hall, Boston.

On June 15, 1926, Warner Brothers established a "talking picture" venture, called the Vitaphone Corporation. The business was based in New York City. Vitaphone contracted Victor to produce musical records that were synchronized with the silent films produced by Warner Brothers. By July, Victor recording engineers were working at Vitaphone's studio at the Manhattan Opera House. The first synchronized musical score was for the picture "Don Juan" with John Barrymore. A number of scores for one-reel short subject films of Victor artists were also produced during 1926.

On June 3, 1927, Raymond Sooy was appointed Superintendent of the Recording Laboratory at Victor's Camden headquarters. He succeeded his brother Harry, who died on May 24. A week after his new appointment, Raymond Sooy directed a milestone recording event. On June 11, Victor made a live recording of the reception for Colonel Charles A. Lindbergh upon his arrival back to the United States. Having just completed his historic transatlantic flight, Lindbergh returned to Washington, DC. Victor engineers recorded the event live via wire from the Camden laboratory (Building #15).

Herbert Hoover, then Secretary of Commerce, made a Victor recording at his Washington, DC office on October 14, 1927. The record, an address to the American Institute of Steel Construction, was played at their convention shortly after. Hoover could not attend the convention and sent his recorded message as the opening speech.

The first Victor recording of the complete chorus of the Metropolitan Grand Opera Company was made in New York on October Hearst's International-Cosmopolitan for January, 1929



LET us pause a moment, gentlemen, and welcome the past. Let us lay aside our invoices and debentures, our politics and our coal bills. . . For tonight an old, familiar company is with us. . . Nelly Bly is here, and Old Black Joe . . Uncle Ned . . . My Old Kentucky Home . . . Jeanie with the light brown hair . . . the Old Folks at Home . . . And with them their banjos and cotton bales, their slow brown rivers and their cabin doors.

Many of these old songs, written by Stephen Foster more than 75 years ago, are known all over the world. Our grandmothers sang them, and our fathers. We our-

selves still love them. . . . And now here they are in their entirety, arranged by Nat Shilkret, beautifully played and sung, and collected in a convenient album.

This is the latest of a long series of Victor Red Seal recordings which are bringing to the musical public the world's most beautiful and important music. Interpreted by the foremost artists and orchestras, recorded with incredible realism by the famous Orthophonic process, they bring within your home the whole horizon of the concert stage. . . The nearest Victor dealer will gladly play you the Stephen Foster album (four double-faced records, list price \$6.00). Hear it at your first opportunity! . . . Victor Talking Machine Co., Camden, New Jersey, U. S. A.

VICTOR Red Seal RECORDS







- 1) A January, 1929 Victor ad for Hearst's International-Cosmopolitan announced a new album of Stephen Foster songs. This collection of popular American folk/blues songs was contained on four double-faced disks. This collection sold for \$6.
- 2) Jazz/Blues artist Jelly Roll Morton joined Victor in the late 1920's and continued to make records for RCA after the 1929 purchase of Victor.
- 3) Dance fever throughout the "Roaring Twenties" contributed greatly to Victor's business. From 1920 to 1929, nearly 340 million records and 4 million Victrolas were sold.

26, 1927. Soprano star Rosa Ponselle held a special recording session at Victor's New York lab on December 8, 1927.

In January 1928, Victor decided to establish its own synchronized recording operation for motion pictures. The Trinity Church recording studio was outfitted with a Western Electric Recording System by March 16. In addition to musical recordings, a library of various sound effects was established. The first commercial soundtrack produced at the Trinity Church studio began on June 16, 1928. The score was for Warming Up, a baseball picture for Paramount. The next picture scored was Paramount's Wings, a story about World War I flying aces. Requiring special sound effects, Victor engineers took their portable recording equipment to Crescent Air Field, Camden. Here they set a microphone on the airstrip, hired an airplane to circle it, and recorded the sounds of the flight. The live sound effects were an effective portion of the score. Wings was awarded the Oscar for best picture at the first annual Academy Awards ceremony in 1928.

The Victor "sound effects library" grew to include automobiles, tractors, army tanks, trains, boats, motorcycles, ocean waves, birds, cheering crowds, laughing crowds and even crying babies.

By early 1929, just prior to the acquisition of the company by RCA, Victor entered the "talking" motion picture business. The first soundtracks were made for 24 short subject (one-reel) "talkies" for Columbia Pictures Company. Additional recording equipment was installed in Trinity Church on January 19, 1929, allowing Victor engineers to re-record soundtracks onto disks. This activity was continued under the RCA Victor Company, Inc. in Camden until 1935.

In the late 1920's, several noteworthy recording artists were added to the Victor catalog. Classical artists Pablo Casals, Richard Crooks, Lawrence Tibbett and Vladimir Horowitz joined the "Red Seal" roster. From the jazz world came Jelly Roll Morton, Bernie Moton, Fletcher Henderson and Duke Ellington. Many of Victor's jazz artists recorded in Chicago, a third location for the company's labs. Fats Waller was recorded at the Trinity Church studio, where he played selections on the pipe organ.

Of the popular orchestras recording for Victor in the late 1920's, several had members who would become leaders of the big band era by the 1930's. The Ben Pollack Band recorded with Glenn Miller, Benny Goodman and Jack Teagarden as session men. Tommy and Jimmy Dorsey, Joe Venuti and Frankie Trumbauer had

all played with the Jean Goldkette Orchestra prior to its breakup in 1927. Between November 1927 and April 1928, the Paul Whiteman Orchestra produced more than 60 selections for Victor. Trumbauer, the Dorseys and Bing Crosby participated in many of these sessions. This large number of recordings was made in a short time frame, since Whiteman's Victor contract was coming to an end. Whiteman then signed with Victor's rival—Columbia.

Acquisitions and Divestitures (1926-1928)

The remaining years of the Victor Talking Machine Company were highlighted by a series of major financial transactions. In 1926, the Company invested \$3.3 million to purchase the NY Talking Machine Company and the Chicago Talking Machine Company. That same year, negotiations began with the Wall Street banking firms of Speyer & Company and J & W Seligman for the purchase of Eldridge Johnson's interest in the Victor Talking Machine Company. The agreement was finalized on December 6, 1926, announcing Johnson's intent to sell his 245,000 shares at \$115 per share. The agreement stipulated that all other Victor common stockholders could also sell on this same basis.

On January 6, 1927, the option was exercised. At 11:30 a.m. representatives from Victor and the firms of Speyer and Seligman entered the Camden Safe Deposit Company. They were met there by Alfred Borden, vicepresident of the National City Bank of New York and Ephraim Tomlinson, president of the Camden Bank. Tomlinson handed the 245,000 shares of stock, which were placed in escrow several weeks earlier, to the representatives of Speyer and Seligman. Borden then telephoned his bank in New York to release \$28 million to the Johnson account in the Camden Safe Deposit Company. This was the largest single financial transaction ever carried out by longdistance telephone at that time.

Johnson's decision to sell control of Victor was based upon his health, concern about inheritance taxes and a desire to retire and relax. He was succeeded as president by Edward E. Shumaker, who was formerly a purchasing agent and then director for Victor.

On the date of Johnson's sale, Victor stock reached a new high of 156.5 on two markets. It was also announced that, on January 17, a dividend of \$2.8 million (\$8 per share) would be paid on the 350,000 total shares of Victor

TWO CENTS

REFINANCING PLANS FOR VICTOR TO GIVE CONTROL TO PUBLIC

Big Financial Deal Approved by Phone

The biggest single financial transaction ever carried out by long distance telephone was yesterday's formal taking up of the option on the controlling interest in the Victor Talking Machine Company.

Representatives of the Victor Company and of the two New York banking firms that purchased the controlling stock from Eldradge Johnson, strolled into the Camden Safe Deposit Company shortly before 11:30 o'clock. Alfred Borden, vice president of the National City Bank of New York, had preceded

Upon their arrival, Borden telephoned to the New York bank. The 245,000 shares of stock, placed in escrow several weeks ago by Eldridge R. Johnson, were handed to the purchasers by Ephraim Tomiliason, president of the CamCapital of Company Will Be Increased \$14,230,000 by Issuance of Stocks in New Series

DECLARE \$8 DIVIDEND TO BE PAID JAN. 17

Edward E. Shumaker Is Elected Head of Firm to Succeed Eldridge R. Johnson as Transfer Is Made

The Victor Talking Machine Company takes up its activities today "under new management."

After a day in which control of the concern had formally passed from the hands of its founder,

1

common stock. Following a reappraisal of the Camden plant, stockholders approved a plan of recapitalization. The company's capital was increased from \$34 to \$49 million by the issuance of a new series of stocks. Control of the Victor Talking Machine Company had now been given to the public for \$53 million.

By the end of 1927, the company had spent \$5.4 million for the purchase of the Southwestern Victor Distribution Company, Dallas; the California Victor Distribution Company, San Francisco; the Northwest Victor Distribution Company, Seattle; the Victor Talking Machine Company of Japan, Ltd. (known today as JVC); and an additional interest in the Victor Talking Machine Company of Canada, Ltd. In 1928, the company sold 32 percent interest in the Victor Talking Machine Company of Japan, Ltd. and invested another \$8.4 million to purchase the Baltimore Victor Distribution Company, the Victor Talking Machine Company of Brazil, the Victor Talking Machine Company of Chile and the remaining balance of the Victor Talking Machine Company of Canada, Ltd.

1) Front page headline of The Camden Morning Post, January 7, 1927, announcing the sale of Johnson's controlling interest in the Victor Talking Machine Company.

RCA Purchases Victor

On March 15, 1929, RCA acquired the Victor Talking Machine Company. RCA, up to this point a communications service and selling agent for radio products built by General Electric Company (GE) and Westinghouse, purchased Victor for its manufacturing facilities and dealers. The acquisition was made after Victor stockholders accepted the following plan: For each share of Victor common, RCA offered one share of RCA common, one share of RCA Class B preferred and \$5.00 in cash. This translated to \$154 million paid by RCA for Victor which, only two years earlier, was bought by the public for \$53 million. David Sarnoff, President of RCA, orchestrated the acquisition with the goal of making his organization financially independent from GE and Westinghouse. RCA borrowed the \$19.5 million needed for the preferred stock and another \$12.5 million for expansion and improvements from GE and Westinghouse.

From March 15 to December 25, 1929, the new venture operated as the "Radio-victor"

Corporation of America." It consisted of two divisions; the Victor Talking Machine Division, responsible for manufacturing Victrolas and records, and the Radiola Division, responsible for manufacturing Radiolas (soon to be called radios). The Camden plant was owned and operated on a 60/40 basis by GE and Westinghouse under the name of "Audio Vision Appliance Company."

The last new product development by Victor as a company was a new radio chassis. Dubbed "Micro-Synchronous," it was advertised successfully throughout the country in 1929. Victor's instrument sales for that year, totaling \$50.5 million, were the largest in the company's history.

By the end of 1929, RCA doubled its common stock issue to repay GE and Westinghouse. On January 1, 1930, the Audio Vision Appliance Company ceased operations. The Radio-victor Corporation of America was merged with the remaining assets of Victor to become the "RCA Victor Company, Inc."

2) One of the last advertisements by Victor, February 1929 (one month prior to the acquisition by RCA), depicts the Radio-Electrola #RE-45. Victor supplied the cabinet, GE/Westinghouse provided the radio.

3) One of the first ads by the Radio-victor Corporation of America, August 1929. Victor artist John McCormack posed with the #RE-45; below was the #RE-32. Victor had, by now, become a division of Radio-victor.





1) Following the purchase of Victor, the Radio Corporation of America established the Radiovictor Corporation of America as the Camden-based distributor for Victrolas and Radiolas. Victor became the manufacturing division for Victrolas and records.



VICTOR TALKING MACHINE DIVISION

Radio-victor Corporation of America

CAMDEN - NEW JERSEY

Summary

So ends the story of the Victor Talking Machine Company, a company which began in a small machine shop with \$50,000 in 1901 and grew to a 58-acre complex and a cumulative volume of approximately \$700,000,000 by 1930. Victor dominated the phonograph and record industry for nearly thirty years, making the "His Master's Voice" trademark and the name of Camden, NJ known throughout the world.

The company's cumulative sales included approximately \$413 million in instruments (over eight million produced), \$272 million in records (nearly 600 million produced), and \$15 million in miscellaneous parts (motors, sound boxes, needles, horns, etc.). Expenses included approximately \$52 million for advertising, \$34 million for space, \$17 million for catalogs, record supplements and sales promotions and \$450,000 for radio broadcasting and other miscellaneous costs.

By 1929, the Camden plant totaled 2.5 million square feet of floor space, housed in 31 buildings. This was equivalent to ten city blocks. The plant consumed nearly 200 tons of coal per day, which was enough to last an average homeowner more than a quarter of a century. The company had its own private railroad system, a 17 million-gallon-per-day water works, a hospital, a restaurant (Victor Lunch Club), a printing plant, a coal wharf and the largest lumber yard in the world handling African mahogany and other cabinet woods. Nearly 10,000 people were employed by Victor at the time. Over 30 key personnel associated with Victor had become millionaires.

Victor records were being produced in over forty languages by 1929. The Victor trademark of "His Master's Voice" had been brought from Camden, NJ to all corners of the globe. Nipper had become the world's most famous dog, and the Victor "Red Seal" label was recognized as the standard in high quality musical recordings. The most memorable "Red Seal" selections from the company were: "O Solo Mio"—Enrico Caruso; "Souvenir"—Misha Elman; "Roamin' in the Gloamin"—Harry Lauder; "Carry Me Back to Old Virginny"—Alma Gluck; "Prelude in C Sharp Minor"—Sergei Rachmaninoff; "Liebesleid"—Fritz Kreisler; "Fiddle and I"—Alma Gluck and Efrem Zimbalist; "Whispering Hope"—Louise Homer and Alma Gluck; "Mother Machree"—John McCormack and "Ave Maria"—Jascha Heifetz.

The phenomenal success of the Victor Talking Machine Company was due to the inventive genius and business savvy of Eldridge Reeves Johnson. His creation of the first constant speed spring motor, an improved recording process and the superior disk record helped to transform the infant phonograph industry into a business of dignity and status almost overnight. Under Johnson's leadership, Victor products were manufactured efficiently and sold at a reasonable price. As a result, the company outperformed the competition and became the most famous name in the industry.

Johnson continued his involvement in civic, political and philanthropic activities following his retirement. His funding support for Camden, in addition to the library system, included the county park system, the Cooper River Beautification Project, the Athletic Club, the YMCA, the construction of the Walt Whitman Hotel (on Cooper Street) and the Deacon's Home (on Kaighn Avenue). He donated scientific encyclopedias to numerous high schools throughout the state of New Jersey. His adopted home town of Moorestown, New Jersey received both the Trinity Episcopal Church and the Community House as gifts. Following Johnson's death in

DELAWARE'S JOHNSON MEMORIAL Master's Voice

1945, his family also donated their home on 255 E. Main Street, Moorestown to the community. which is the present-day Lutheran Home. Eldridge Johnson, the philanthropist, is best summarized by his own words:

2

"We are responsible to the younger generation for many things that came to us naturally when we were young. The best things in life are still free, but we must make them accessible. No man can be happy who is not in touch with humanity."

This concludes the story of the Victor Talking Machine Company, the first of three "Twentieth Century Communications Pioneers" in Camden, NJ. Further information on this fascinating company can be obtained from two valuable sources today. The Camden County Historical Society maintains both an exhibit and archival records at its Pomona Hall home on Park Boulevard and Euclid Avenue, Camden, NJ. The Delaware State Museums feature an extensive collection of Victor talking machines, Victrolas, early recordings and an original oil painting of "His Master's Voice" at the Johnson Memorial Museum (recently renamed the Johnson Victrola Museum). This unique exhibit is located at Bank Lane and New Street in Eldridge Johnson's boyhood hometown of Dover, DE.

The story of "His Master's Voice" in America now shifts to the story of the Radio Corporation of America, the next "Twentieth Century Communications Pioneer" that carried the famous trademark from Camden, NJ to the world.

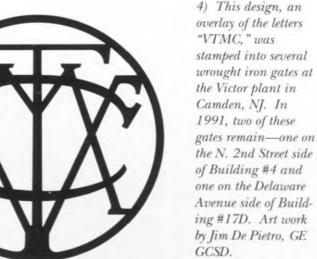
POMONA HALL

home of the

Camden County Historical Society



- 2) The Delaware State Museums maintain an interesting display of Victor talking machines, Victrolas and records at the Dover-based Johnson Memorial Museum. Eldridge Johnson's personal files are also housed here. Nipper enthusiasts are always welcome. Courtesy: Delaware State Museums.
- 3) The Camden County Historical Society is a valuable source of information on the Victor Talking Machine Company. It holds archival records, Victor instruments, an original "His Master's Voice" replica painting by Francis Barraud and one of the original Nipper stained-glass windows from the Victor cabinet factory tower. Courtesy: Camden County Historical Society.







Chapter 4

The Radio Corporation of America: The First Decade (1919-1929)

"I have in mind a plan of development which would make radio a 'household utility' in the same sense as the piano or phonograph. The idea is to bring music into the house by wireless..."

— David Sarnoff, 1915

he story of the Radio Corporation of America (RCA) is the story of the most recognized name in communications, electronics and entertainment of the twentieth century. It is the story of pioneering in radio and television broadcasting and products. It is also the story of leadership in both military and space-based electronics. For 67 years, RCA touched the lives of millions of people worldwide. From research and design to manufacturing and service, RCA set standards that few could match. Through the extraordinary talents and dedication of the "RCA Family" of employees, America was entertained and defended for over six decades. RCA, through its multitude of technological achievements became *The Most Trusted Name in Electronics*.

The RCA story begins many years prior to the acquisition of the Victor Talking Machine Company of Camden, NJ in 1929. It, in fact, begins in 1919 with the incorporation of RCA. This chapter focuses on the first decade of the Radio Corporation of America and the events leading up to the company's acquisition of the Camden facilities. Chapter 5 addresses the first decade of RCA in Camden.

To begin the RCA story, some background on a number of important events prior to 1919 is required.

The Invention of Wireless Communications

In 1895, a young Italian electrical engineer named Guglielmo Marconi transmitted the first signal by wireless in home tests, bringing to life a new form of communications. He filed his first patent on June 2, 1896 in England, with plans to commercialize his new invention. On July 2, 1897 he received the British patent and formed the Wireless Telegraph and Signal Company in England as the first commercial

David Sarnoff (1891-1971) as Commercial Manager of the Radio Corporation of America, October 1919.

1) Guglielmo Marconi (1874-1937), Italian electrical engineer and inventor of wireless communications, with the apparatus he used in 1901 in Newfoundland for the first receipt of a transatlantic radio signal.



telegraph service. The US patent was granted on July 13, 1897. On November 22, 1899 the Marconi Wireless Telegraph Company of America was incorporated. These two enterprises launched the first short distance wireless service between shore-based stations and ships at sea.

Marconi next attacked the problem of long distance wireless communications. He built a station at Poldhu, Cornwall, England with a 12-kilowatt transmitter as part of a plan to send signals across the ocean. He then built a crude apparatus and a kite-mounted antenna for reception of these signals. On December 12, 1901, Marconi stunned the world when he successfully received the first trans-atlantic radio signal high above the Grand Banks of St. John's, Newfoundland, Canada from Cornwall, England. He picked up three dots (the letter "S") from 1,800 miles away. Long distance communications by wireless was born.

In the following months entire words were sent and received. The US Navy Department was so impressed that it soon began to use this new service as a replacement for carrier pigeons.

The first transmission and receipt of a human voice by wireless was demonstrated by Dr. Reginald Fessenden in Pittsburgh, PA on December 23, 1900. He began work on continuous-wave transmissions the following year.

On January 9, 1903, Marconi's company sent a telegraphic message from President

Theodore Roosevelt to King Edward VII of England.

Wireless telegraph stations were starting up on coastlines around the world by 1904. That year, Lee De Forest demonstrated wireless at the St. Louis World's Fair and John Ambrose Fleming of University College, London, repatented the "Edison effect" as a radio rectifier. Fleming's "diode" valve was further modified in 1906 by Lee De Forest, who incorporated a third valve and invented the "triode" or "audion." These inventions by Fleming and De Forest set the stage for radio and broadcasting. The first "broadcast" of a phonograph record was made by Fessenden in 1906.

By this time, the American branch of Marconi was at the forefront in the wireless industry. Marconi held the most important patents in his field. His British and American companies were recognized as the best, even though they were not the largest. Of the 20 US land-based stations, only four were Marconi: Sea Gate at Coney Island, NY; Sagaponack on Long Island, NY; Siasconset at Nantucket, MA; and South Wellfleet on Cape Cod, MA.

In 1906, the first and only wireless service in New York City was the Marconi office at 27 William Street. On September 30, this office hired a 15-year-old office boy who was eager to become a wireless operator. His name was David Sarnoff.

David Sarnoff and the Marconi Wireless Telegraph Company of America

The story of David Sarnoff, the guiding genius of the Radio Corporation of America and a dominant figure in the world of modern communications for over 50 years, is one of amazing achievement. Born on February 27, 1891, in the small village of Uzlian, near the city of Minsk, Russia, he was brought to the United States by his parents in 1900. Living in the immigrant ghetto of "Hell's Kitchen" on the lower east side of Manhattan, Sarnoff was determined to rise above his surroundings.

Due to his father's failing health, young Sarnoff realized that, upon graduating elementary school, he had to enter the working world. Having aspirations to become a news reporter, he took a job at the *New York Herald* at 35th Street and Broadway as a messenger boy in 1906. It was here that he became fascinated with telegraphy. He invested his earnings in a \$2.00 dummy telegraph key and Morse Code instruction book and began teaching himself night after night at home. Within a few months he had become quite skilled. Eager to become a wireless operator, Sarnoff accepted a job at the Manhattan office of the Marconi Company

on September 30, 1906, as an office boy for \$5.50 per week. This date marked Sarnoff's entry into the electronics world.

In 1908, Sarnoff became a full-fledged wireless operator for American Marconi, assigned to the Siasconset station on Nantucket Island, MA. The 17-year-old's salary was increased to \$60 per month. He was appointed manager at the Sea Gate, Coney Island station in 1909. Two years later, he applied for, and received, the post that was to have a great impact on his career. Sarnoff became both operator and manager of the five-kilowatt Marconi station on top of the John Wanamaker department store in New York City. This station was the most powerful in the commercial field at that time.

It was here that, on April 14, 1912, Sarnoff picked up the following message from the SS Olympic, 1,400 miles away: "SS Titanic ran into iceberg. Sinking fast." The Titanic, the largest, fastest and most luxurious passenger ship in the world, was on its maiden voyage from Great Britain to New York when the disaster occurred. The news was quickly given to the press. As word spread, countless other coastal and ship-based telegraph stations tried

2) In 1908, David Sarnoff (age 17) was a wireless operator at the American Marconi Station at Siasconset, on Nantucket Island, MA. Courtesy: David Sarnoff Research Center.



to assist. This caused interference in the airwaves and President Taft ordered them all off the air except Sarnoff's station. For the next 72 hours, Sarnoff received the terrible news and relayed it to the world. When it was over, 1,517 people had drowned, including several prominent Americans and Europeans. Sadly, it took a tragic event like this to awaken America and the world to the importance of radio. Congress quickly passed a new law requiring all ships carrying over 50 persons to be equipped with radio.

The *Titanic* disaster also launched Sarnoff to fame. Within a year, he was promoted twice: first to Marconi's chief inspector for ships in New York harbor; then to national inspector. Shortly after, he became assistant traffic manager.

From 1907 to 1912, the wireless industry had made great strides. The General Electric Company, Schenectady, NY was well along in developing the Alexanderson alternator. This 20,000-cycle high frequency alternator would, by 1919, provide the necessary power for continuous-wave wireless communications across the oceans. In January 1910, Lee De Forest made the first live wireless transmission from the Metropolitan Opera in New York. The voice of Enrico Caruso was heard "on the air" for the first time, though only by the few local amateur operators with the appropriate equipment.

By 1912, the word "radio" displaced "wireless," derived from the fact that these signals "radiated" in all directions. The terms "radiotelegraphy" and "radiotelephony" entered the vocabulary of the US Navy to distinguish wireless code and voice communications from wired communications.

Further advances in voice communications were brought about by Edwin Howard Armstrong, who began experimenting with the De Forest triode to amplify incoming radio signals. On October 29, 1913, Armstrong filed for the US patent for his "feedback" or "regenerative" circuit. The technique involved feeding back a portion of the current from the plate of a vacuum tube to the grid, where it was amplified many times. This made the tubes much more sensitive, allowing signal reception from greater distances. This technique also enabled the tube to be used as an oscillator for transmitting. The Armstrong "feedback" patents were eventually bought by Westinghouse in 1920 for nearly half a million dollars.

The rapid progress in the radio industry



was being duly noted by Sarnoff. General Electric and Western Electric were both making progress in radiotelephony. A young professor of engineering at the College of the City of New York, Dr. Alfred Goldsmith, had gained a reputation among amateurs with his regional broadcast programs. The American Telephone and Telegraph Company produced a giant transmitter for the US Navy radio station in Arlington, VA, which combined numerous improved vacuum tubes with the Armstrong "feedback" system. Voice programs conducted in September-October 1915 from this station were heard as far as Paris and San Francisco.

Sarnoff noted that most experimenters were concentrating on the limited use of radio as a substitute for wired point-to-point communication. He began a plan in 1915 which he proposed to Edward J. Nally, vice-president and general manager of the Marconi Wireless

 On April 15, 1912, at the Marconi telegraph station atop the John Wanamaker department store in New York City. Sarnoff (age 21) listened to the distress signals of the sinking Titanic. President Taft ordered all other radio stations silenced while Sarnoff received the names of the survivors. Over 1500 people lost their lives. For the first time the name of David Sarnoff was heard across the nation. Courtesy: David Sarnoff Research Center.

Telegraph Company of America. This plan, he felt, would redirect the company and keep it competitive in the fast-growing wireless industry. The following excerpt from a memo written by Sarnoff to Nally in the Fall of 1915 was an accurate preview of the home radio:

"I have in mind a plan of development which would make radio a 'household utility' in the same sense as the piano or phonograph. The idea is to bring music into the house by wireless..."

"For example, a radio telephone transmitter having a range of say 25 to 50 miles can be installed at a fixed point where instrumental or vocal music or both are produced. The problem of transmitting music has already been solved in principle and therefore all the receivers attuned to the transmitting wave length should be capable of receiving such music. The receiver can be designed in the form of a simple 'radio music box' and arranged for several different wave lengths, which should be changeable with the throwing of a single switch or pressing of a single button."

It is interesting to note that Sarnoff's fiscal predictions in this memorandum turned out to be almost exactly what was realized by the Radio Corporation of America by 1924:

"It is not possible to estimate the total amount of business obtainable with this plan until it has been developed and actually tried out; but there are about 15,000,000 families in the United States alone, and if only one million or seven percent of the total families thought well of the idea it would, at the figure mentioned [\$75 per outfit], mean a gross business of about \$75,000,000 which should yield considerable revenue."

The memorandum seemed interesting but a bit too amazing to Nally, who filed it and forgot about it.

By 1916, World War I had been raging in Europe for two years. The US Government was attempting to pass legislation to gain control over radio stations for military use in the event of US entry into the conflict.

On January 1, 1917, the Marconi Wireless Telegraph Company of America was reorganized, centralizing many of its activities into a new Commercial Department. The 25-year-old Sarnoff was named Commercial Manager, making him second-in-command to Nally. He was responsible for 725 employees and 582 ship-based radio installations. He negotiated all service contracts, headed sales both to govern-



2) Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, became the first president of RCA following its birth on October 17, 1919.

ment and commercial customers and regulated the company's radio and telegraph operations.

The United States broke off diplomatic relations with Germany in February 1917, and entered World War I in April. The Government took control of all high-powered radiotelegraphy stations, including those of American Marconi. The Navy became the main user and, with the previous problem of patent infringement gone, was able to quickly advance the technology. It quickly completed Marconi's new station at New Brunswick, NJ, installing a 50-kilowatt Alexanderson alternator. This became the most powerful station in the world and was used by President Woodrow Wilson to broadcast his historic address on his "Fourteen Points" for peace to the world. This speech, given to Congress on January 8, 1918, was heard by both friendly and enemy nations and had a positive impact on ending the war later that year.

American Marconi was the largest supplier of radio equipment to the US Government during the war. Sarnoff was instrumental on the selling end. The Government had developed a profound appreciation for radio during the war and decided that this industry was too vital to the nation's interests to be dominated by foreign-owned companies. President Wilson and the Navy Department were especially concerned about the Marconi Wireless Telegraph Company of America, which was a British-owned subsidiary.

The Formation of the Radio Corporation of America (1919)

A prominent figure during World War I, responsible for research and engineering of military communications, was the Assistant Secretary of the Navy, Franklin Delano Roosevelt. By the conclusion of the war, he and other senior members of the Navy Department were devising a plan to keep radio patents and facilities in the hands of US-owned companies.

Meanwhile, British Marconi had resumed discussions with General Electric to purchase exclusive rights to the Alexanderson high-frequency alternator. These discussions, which started in 1915 between Guglielmo Marconi and General Electric's head of the Legal Department, Owen D. Young, had been interrupted by the war. By December 1918, tentative plans were formalized. Owen Young then notified the US Government of the impending plans. The Government reacted immediately.

On April 4, 1919, Roosevelt wrote a letter to General Electric, requesting it suspend negotiations for the sale of the Alexanderson alternator to British Marconi until after a conference with the Navy Department. The conference was held at GE's offices in New York on April 8. Rear Admiral William Bullard and Commander C.S. Hooper of the Navy Department represented the Government. GE was represented by E.W. Rice, Jr., president; Owen D. Young, now vice-president; Albert G. Davis, head of the Patent Department; Edward P. Edwards and C.W. Stone. Bullard urged GE to break off negotiations with British Marconi and presented a plan for the establishment of an all-American organization that could acquire the assets of American Marconi. It was also proposed that GE take the initiative in assembling this new organization. GE agreed to the proposal. The next step was to convince British Marconi to sell its American subsidiary. The US team, led by American Marconi's Nally and GE's Davis, immediately sailed for England. For the next three months, strenuous negotiations ensued, resulting in an agreement for the sale of the American subsidiary.

The Radio Corporation of America was officially organized on October 17, 1919. Edward J. Nally was named President, Elmer E.

1) RCA's first laboratory was set up in an Army tent near Riverhead, Long Island, NY in 1919 to perform tests using a six-mile-long ground wire as an unidirectional antenna. This photo was shot in the Spring of 1920 of engineers (sitting, l-r): Harold Olson, Chester W. Rice, Edward W. Kellogg, Ralph Greenman and (standing) Harold H. Beverage. All were GE employees, except Olson. They reported to Dr. Alexanderson, the first chief engineer of RCA. Courtesy: David Sarnoff Research Center.







Bucher became Commercial Engineer in charge of sales and David Sarnoff assumed the title of Commercial Manager. George De Sousa became Treasurer and Ernst F.W. Alexanderson, inventor of the famed alternator, was named Chief Engineer.

On November 20, 1919, the Marconi Wireless Telegraph Company of America's assets and business were taken over by RCA. That same day a cross-licensing agreement was made between GE, who held various radio patents, and RCA, who now held the Marconi patents.

Under the terms of the advance agreement with the Navy Department, GE held a controlling interest in RCA and was responsible for all manufacturing. At the time, GE was producing vacuum tubes at its Edison Lamp Works in Harrison, NJ and at the National Lamp Works (Nela Park) near Cleveland, OH. Transmitters and receivers were built at GE's plant in Schenectady, NY and at the American Marconi plant at Roselle Park, NJ. RCA was to be responsible only for marketing and sales of GE and Westinghouse products, and for providing the marine and trans-oceanic communications services. The agreement also limited ownership of RCA by foreigners to 20 percent. Owen D. Young was elected Chairman of the Board of RCA and the company began business on December 1, 1919.

The first two years of RCA were highlighted by growth in international communications services, cross-licensing activities, pioneering efforts in broadcasting and the introduction of the first radio products.

2) In 1921, David Sarnoff demonstrated RCA's experimental trans-oceanic communications station at New Brunswick, NJ, to a group of distinguished scientists. The group, (l-r) included: first three men unidentified, David Sarnoff, Thomas J. Hayden, Dr. E.J. Berg, S. Benedict, Prof. Albert Einstein, Nikola Tesla, Dr. Charles P. Steinmetz, Dr. Alfred N. Goldsmith, A. Malsin, Dr. Irving Langmuir, Dr. Anthony W. Hull, E.B. Pillsbury, Dr. Saul Dushman, R.H. Ranger, Dr. G.A. Campbell and Ernst F.W. Alexanderson, last man unidentified. Later that year, RCA opened its "Radio Central"—the world's largest transmitting station—at Rocky Point, Long Island. Courtesy: David Sarnoff Research Center.

Communications Services (1920-1921)

On January 14, 1920, President Wilson appointed Rear Admiral William Bullard as the government representative to attend all meetings of the RCA Board of Directors. The following month, all high-power stations that had been under government control during World War I were returned to US companies. On February 29, commercial long distance radio telegraph communications between the United States and foreign countries was inaugurated by RCA.

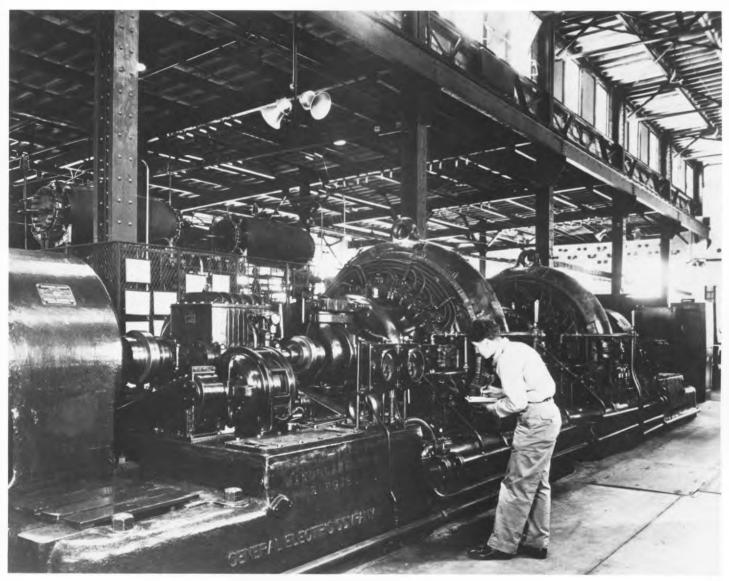
In 1920, RCA began installing GE-produced 200-kilowatt Alexanderson alternators for international communications at Bolinas, CA; Marion, MA; and Kahuku, Hawaiian Islands. On March 1, RCA opened international

services between New York and Great Britain, San Francisco and Hawaii, San Francisco and Japan, and Hawaii and Japan. Service began between New York and Norway on May 17, between New York and Berlin, Germany on August 1, and between New York and France on December 14. By the end of 1920, RCA was handling a million words a month in overseas messages.

RCA's growth in international communications services continued in 1921. In September, the coastal stations of the International Radio Telegraph Company were taken over, thus adding to its system the stations at Belfast, ME, Siasconset, MA, New London, CT, New York, NY and Cape May, NJ. In October, RCA entered into a consortium with

1) The main transmitter station for RCA
Radio Central, the world's
largest radio telegraph
station, opened at Rocky
Point, Long Island, NY
on November 5, 1921.
Note the longwave and
shortwave antennas.
The "swimming pool"
in front of the building
acted as the cooling
system for the vacuum
tubes and transmitters.





firms in Germany, France and England for the development of radio communications in South America. To meet the needs of its rapidly-growing global network, RCA began construction of "Radio Central," a massive station which eventually encompassed ten acres at Rocky Point, Long Island, NY. The first segment was officially opened by President Warren Harding on November 5, 1921. His address was heard by stations in Europe, Australia, Hawaii, Japan, Central America and across the United States. Sarnoff supervised the ceremonies in the absence of RCA's President Nally, who was on overseas business. Owen Young gave the keynote address. The opening of Radio Central marked another milestone in the wireless communications industry and thrust RCA and GE further into the forefront of that industry.

2) The Alexanderson high frequency alternator was used at a number of RCA coastal stations, including the RCA communications transmitting station at Rocky Point, Long Island. Part of the 200-kw long wave transmitter system, this machine at the time carried the entire load of overseas radio traffic. The alternator, invented by Swedish-American engineer Ernst F.W. Alexanderson and built by GE, occupied a bedplate 10' wide x 18' long and stood 10' high. Three-ton rotors mounted on 8" diameter nickel-steel shafts revolved 20,000 rpm to produce up to 26 kilohertz at 200 kilowatts. The continuous-wave radiations generated were fed into longwire antennas which were held aloft by a series of 420' high towers. Courtesy: David Sarnoff Research Center.

Patent Exchanges, First Radio Broadcasts and Products (1920-1921)

RCA began organizing an inter-company plan for radio broadcasting and development of Sarnoff's "radio music box" in 1920. It began with a Sarnoff memo to Owen Young in January, suggesting a reconsideration of the proposal he made five years earlier to Nally at American Marconi. This was followed by a letter in March to E.W. Rice, president of General Electric, in which Sarnoff provided a rough sales forecast. Based on a \$75 unit price, he predicted the sale of a million home radio receivers within three years. He divided it as:

First year - 100,000 units - \$7,500,000 Second year - 300,000 units - \$22,500,000 Third year - 600,000 units - \$45,000,000 Total - \$75,000,000

Total - \$75,000,000

(RCA's actual sales were to be \$11,000,000 in 1922, \$22,500,000 in 1923 and \$50,000,000 in 1924, for a three-year total of \$83,500,000. The actual results were remarkably close to Sarnoff's predictions).

GE supported the plan, which called for a number of actions to break the patent deadlock existing in the US. Without a number of critical pieces, GE could not legally manufacture a complete radio receiver for the home. Nor could RCA successfully expand its international communications service or enter the radio broadcasting field.

The first action involved the American Telephone and Telegraph Company. Strong patents on vacuum tubes for medium-power transmitters and receivers were held by both GE and the American Telephone and Telegraph Company, but neither could effectively use its own patents without infringing on the other's. AT&T held rights to the De Forest triode, which was of great interest to GE and RCA. The Navy Department again stepped in, urging both companies to come to an understanding "for the good of the public." A cross-licensing agreement between GE, RCA and AT&T was made on July 1, 1920. GE and RCA were granted use of AT&T's wireless patents and the De Forest tube patent. AT&T received rights to use GE and RCA patents in telephone development. The telephone company also received 500,000 shares of RCA common stock and purchased an additional 500,000 shares of RCA preferred.

On March 7, 1921 a cross-licensing agreement was made between GE, RCA, the Wireless Specialty Apparatus Company of Boston, MA and



1) Jack Dempsey, world heavyweight boxing champion, listened to a Westinghouse "Aeriola" radio music box for the first time just prior to his bout with challenger Georges Carpentier on July 2, 1921.

1

the United Fruit Company for additional patents. The Wireless Company was producing radio apparatus for the Tropical Radio Company. Tropical was a subsidiary of the United Fruit Company, operating the ship-to-shore communications service for United's shipping fleet. United Fruit traded patents for 200,000 shares of RCA common stock. GE also purchased an interest in the Wireless Company.

E.T. Cunningham, who had been making tubes for amateurs on the West Coast, entered into an arrangement with RCA in 1920 which licensed him to sell GE and Westinghouse tubes under his own name.

The last key cross-licensing agreement came on June 30, 1921 with the Westinghouse Electric & Manufacturing Company. Having acquired the rights to the Armstrong "feedback" patent a year before, Westinghouse held a vital ingredient needed by RCA and GE. Westinghouse had made an attempt to enter the radio field on its own in 1920, intending to compete with RCA/GE. It set

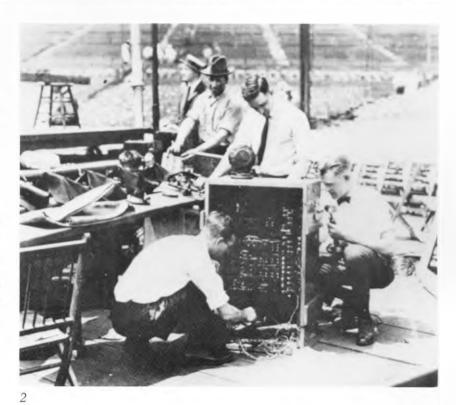
up a subsidiary called the International Radio Telegraph Company, which had acquired a number of Fessenden's patents. The venture ran into difficulty and Westinghouse then bought the exclusive rights to several Armstrong and Pupin patents, including the Armstrong "feedback" patent. Westinghouse turned its patents into the RCA pool in exchange for 1,000,000 shares of RCA common and 1,000,000 shares of RCA preferred stock. It was also agreed that the planned radio music boxes would be manufactured jointly by General Electric and Westinghouse, in the proportion of 60 percent GE and 40 percent Westinghouse.

With the pooling of patents complete, the radio group of RCA, GE and Westinghouse could now legally manufacture and sell a complete radio set and construct a complete broadcasting station.

Westinghouse had already received the first commercial broadcasting license from the US Department of Commerce on October 27, 1920. Its KDKA station in Pittsburgh began broadcasting one hour per day in November, beginning with the Harding-Cox presidential election returns. Inspired by Westinghouse's pioneering success, RCA quickly followed suit.

The first broadcast by RCA was made on July 2, 1921, when it set up a temporary station at Hoboken, NJ to report the world heavyweight boxing championship between Jack Dempsey and the French challenger, Georges Carpentier. A temporary broadcast booth was set up at Boyle's Thirty Acres in Jersey City, NJ, where the blowby-blow desciption was telephoned by Major J. Andrew White from the stadium to the transmitting station at Hoboken. White's words were typed as they came over the phone and were then read over the air by J.O. Smith. The US Department of Commerce assigned the call letters WJY for the one-time broadcast. The broadcast was made possible with the assistance of Franklin Roosevelt, who convinced his colleagues in the Navy Department to lend its commercial radiophone transmitter for the event. Recently produced and delivered by GE, this was the largest transmitter of its type in the world. The event was brainstormed by Sarnoff, who had just been promoted to General Manager of RCA in May 1921. The broadcast was hailed as a complete success, reportedly heard by more than 200,000 people within 500 miles.

RCA's first regularly operated broadcasting station, WDY, opened at Roselle Park, NJ on December 15, 1921. Operations at WDY, however, interfered with Westinghouse's nearby



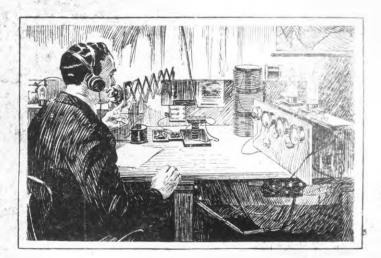


- 2) Technicians installed a temporary broadcasting station at Boyle's Thirty Acres in Jersey City, NJ for RCA's first broadcast (the Dempsey-Carpentier world heavyweight championship fight), July 2, 1921.
- 3) RCA's first broadcasting station, WDY in Roselle Park, NJ, began operating on December 15, 1921. Due to interference with the Westinghouse-owned station of WJZ in nearby Newark, this station was closed on February 15, 1922 and operations were moved to WJZ, where RCA became partners with Westinghouse. By spring 1923, RCA acquired full ownership of WJZ.

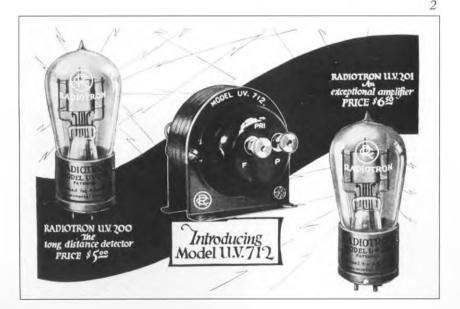
RADIO APPARATUS

Amateur and Experimental Use

With Instructions Por Continuous Wave Operation







station of WJZ in Newark, which also opened in 1921. WDY was shut down on February 15, 1922 and RCA moved its operation to WJZ, becoming partners with Westinghouse. Westinghouse had also established a third station by late 1921, WBZ, in Springfield, MA. Commercial broadcasting was taking shape.

GE and Westinghouse were taking steps to develop more efficient radio transmitting and receiver apparatus, which RCA began to sell in 1921. The first RCA product catalog was published in September. It offered a variety of radio apparatus for amateur and experimental use, including Westinghouse's type "RC" for \$125 and "Aeriola Jr." for \$25.

From January to November, 1921, GE and Westinghouse produced a combined five thousand receiving tubes per month for sale by RCA. By June 1922, RCA had sold 200,000 tubes. On October 15, 1922, GE high-power, 20-kilowatt vacuum tubes were used for the first time in RCA trans-oceanic transmitters.



4

3

- 1) The first radio product catalog issued by the Radio Corporation of America in 1921. The Sales Division was then located in the Woolworth Building, 233 Broadway, New York City. The apparatus described within were strictly for amateur and experimental use. Courtesy: R.F. Smith.
- 2) Vacuum tubes "UV-200 and 201" and an amplifying transformer (UV-712), were manufactured by GE and sold by RCA in the 1921 product catalog. The prefix letters "UV" dubbed by RCA's George H. Clark, stood for "unit vacuum."
- 3) The shortwave regenerative receiver model RC, introduced in 1921, was one of the first sold by RCA. It was manufactured by Westinghouse. The price, minus the tubes, was \$132.50. The RC was a combination of tuner RA (left) and detector-amplifier DA (right).
- 4) The inexpensive "Aeriola Jr.," designed for the radio novice, was built by Westinghouse and advertised in the 1921 RCA catalog.
- 5) The registration for RCA's first trademark, received January 10, 1922. Courtesy: Thomas T. Flythe, Sr.

UNITED STATES PATENT OFFICE.

RADIO CORPOBATION OF AMERICA, OF NEW YORK, M. Y.
TRADE-MARK FOR ELECTRICAL VACUUM TUBES AND VALVES.
ACT OF FERRUARY 10, 1005.

150,947,

Registered Jan. 10, 1922.

application filed April 28, 1921. Serial No. 105,928.

STATEMENT.

The trade-mark has been continuously used in the business of said corporation since Oct tober 25th, 1920.

The trade-mark is applied or affixed to

RADIO CORPORATION OF AMERICA, By GEORGE 5. DE SOUSA,



DECLARATION.

State of New York, country of New York, as Grazone S. De Soras, being duly aworn deposes and says: that he is the treasurer of the evoporation, the applicant named it the foregoing statement; that he believes the such corporation is the owner of the trademark sought to be registered; that no other person, firm, corporation, or association, to the best of his knowledge and belief, has the right to use the said trade-mark in the or in any such near resemblance thereto at might be calculated to deceive; that said trade-mark is used by such corporation in commerce among the several States of the United States; that the description and drawing presented truly represent the trademark sought to be registeric); and that the specimens show the trade-mark as actually used upon the goods.

GEORGE S DE SOUSA

5

Subscribed and sworn to before me, a noury public, thin 25th day of April, 1921.

[1. 8.] WILLIAM J. SCHMIDT,
Notary Public.

First Trademarks (1920-1922)

On October 25, 1920, the Radio Corporation of America began using its first trademark. The superimposed letters "RC," enclosed by a circle, were applied to the first radio products. RCA filed the application on April 28, 1921 and received the registration on January 10, 1922.

This symbol was used until September of that year, at which time a new trademark was introduced. The letter "A" was added to reflect the full name of the company and a lightening flash was also incorporated into the design. RCA filed for US registration on September 22. The new symbol was launched nationwide with a tribute by Marconi that same month. This new monogram would continue unchanged for the next 42 years.

Organizational Developments (1922-1925)

By 1922, the Radio Corporation of America was well on its way in communications services, radio broadcasting and radio products.

Staff changes during this period included the promotion of Sarnoff to Vice-President and General Manager in September 1922, the selection of Major General James G. Harbord (USA, Retired) as RCA's second President in 1923, and the appointment of Dr. Alfred N. Goldsmith as the new Director of the Research Department. Goldsmith succeeded Alexanderson, who returned to GE in 1923.



To Protect The Dealer and The Public

A new trademark, a symbol of quality, has been adopted by the Radio Corporation of America. It appears at the top of this page, and soon it will be affixed to all Radiolas, Radiotrons and other products.

The new symbol is more than a trademark. It is the dealer's and the purchaser's guarantee that the apparatus to which it is applied is the result of research conducted by the foremost scientists and engineers; is the product of the most reliable and well equipped manufacturing organization in the country; and is marketed in accordance with methods approved by experienced business men.

Like the R C A apparatus still on sale, bearing the old symbol – the letters R C, in a next—the needy marked R C A apparatus will embody the same high standard of quality and will be backed by the same protection which R C apparatus has enjoyed during the pair.

has enjoyed during the past.

The new monogram has been adopted to render sprarem, mutantly and unminishably, the products of the Radio Corporation of America. Henceforth, this symbol RCA will appear on all apparatus and Radiolas—from the simplest crystal receiver to the Cabuset type. It testifies to the constant striving of

orp pace with the advancement of broadcast recepon and which will apply the new discoveries made the R.C.A. research laboratories.

Teaching the Public H'hat R C A Means Through Advertising

Intrough Advertising
The new spinds IR A will be widely advertise
throughout the country. In an art which is so ra
still developing and which offers so many epoturning for the marketing of unreliable appuarant,
becomes more and more necessary to drive how
the importance of the highest engineering an
natural entrough grandards. The symbol R CA is
guarantee that these standards here been masses
upon in the manufacture of Radolas.

Write for Display Cards

R C A dealers will be supplied such R C A symbols for some dealer. By writing to us and stating whether a decalerament window



21) Breadway, New York, N. Dierie Office 10 South Le Selle St., Chicago, III.

(



- 6) The first announcement for RCA's second trademark, fall 1922.
- 7) Major General James G. Harbord (US Army, Retired), who had been General John J. Pershing's chief of staff in World War I, became RCA's second President in 1923.

Communications Services (1922-1925)

The combined forces of RCA, GE, Westinghouse and AT&T achieved numerous firsts during this period. A new high-power, long distance tube transmitter was developed. Through direct connection between land line telephone wires and radio, RCA and AT&T successfully demonstrated two-way telephone conversations between the SS America at sea and ordinary telephones in homes and offices in 1922. Simultaneous radio telegraph and telephone communications were also demonstrated.

RCA began conversion of spark transmitting apparatus aboard ships to vacuum tube operation in 1922. This was an important first step toward eliminating extraneous noise during broadcasting and reception. The company began replacing ship-based crystal detectors with vacuum tube detectors and amplifiers, greatly increasing the range of ship-to-shore and ship-to-ship communications.

By April 1922, GE had manufactured 17 Alexanderson alternators at the Schenectady plant for various coastal stations in the US and overseas. Seven of these stations were operational at this time: New Brunswick, NJ; Marion, MA; Tuckerton, NJ; Kahuku, HI; Bolinas, CA; Radio Central, Long Island, NY; and Caernarvon, Wales. Each station cost about \$2 million and contained two of the 200-kilowatt alternators. The stations in Hawaii and California were dedicated to Pacific traffic, with the others handling the Atlantic. Radio Central, New Brunswick, Tuckerton and Marion all had land lines directly to RCA's New York City offices. The cost for the service between New York and Wales was 18¢ per word, compared to 25¢ per word for cable.

RCA demonstrated its proficiency in managing a heavy load of international radio telegraph communications twice in 1922. First, the company picked up the majority of trans-atlantic traffic in August, when cable service was interrupted. It also handled an increased load of transpacific traffic in December, when the only cable between the US and Japan was broken.

Another significant achievement was made on October 15, 1922 when the company handled the first trans-oceanic traffic (between New York, England and Germany) using high-powered vacuum tube transmitters.

In 1923, RCA inaugurated a high-power, long distance press service to ships at sea. Vessels within a radius of 4,000 miles were now able to publish a daily newspaper at sea.

On October 4, 1923, RCA established the first radio communications circuit between the

United States and Poland. The company also began research and development of short wave, low-power communications in 1923, and began to upgrade both its Atlantic and Pacific circuits the following year. The first radio telegraph communication circuit between the US and Argentina was opened by RCA on January 25, 1924 and between the US and Sweden on December I, 1924.

On July 6, 1924, RCA made the first transmission of a radio photograph across the Atlantic. A photo of Charles Evans Hughes was sent from New York to London, where it was radioed back to New York and recorded. Similar tests across the Pacific were successfully conducted on May 7, 1925, when various messages, maps and pictures were transmitted from New York to Honolulu.

RCA's international network was further expanded with the opening of the first circuit to the Dutch East Indies on July 16, 1925.

A final noteworthy achievement of this period was the development of radio direction finders, which RCA began to install on ships in 1925. The *SS Dalton*, based on the Great Lakes in Toledo, OH, was the first to be outfitted.

Radio Broadcasting (1922-1926)

With the issuance of the first commercial licenses by the US Department of Commerce in September 1921, the broadcast era had officially begun. During 1922 the Government issued over 600 licenses. Stations west of the Mississippi received the call letter "K"; those to the east



1) On July 6, 1924, this radio photo (of Charles Evans Hughes) was the first to be sent by RCA across the Atlantic.



received a "W." The Radio Corporation of America and its associates quickly advanced in this field during the early 1920's.

Westinghouse already had established three stations by 1921. GE established its first station, WGY, in Schenectady, NY, and went "on the air" February 20, 1922. AT&T, which was actively developing the use of wire lines for supplying programs for broadcasts, established station WEAF in New York City and began broadcasting on August 16, 1922. The first paid radio commercial in America was aired by WEAF on August 28. The broadcast was a real estate talk sponsored by the Queensborough Corporation. The cost for the ten-minute segment was \$100.

RCA had assumed management of Westinghouse's station WJZ in Newark, NJ in 1922. A rivalry between RCA and AT&T began, due to a conflict of interest involving the building and operation of broadcasting stations. The battle revolved around an ambiguous clause in the earlier agreements made between the two in 1920. A vigorous competition between WJZ and WEAF ensued, with RCA and AT&T each trying to score "firsts" in broadcasting. RCA teamed up with GE to form the first radio network hookup for reporting the World Series in baseball. The dual broadcast of WJZ, Newark and WGY, Schenectady began on October 27, 1922. AT&T countered with the first broadcast of a major football game.

RCA opened the twin broadcasting stations of WJZ and WJY in new studios at Aeolian Hall on 42nd Street, in New York City on May 15, 1923. WJZ was moved here from Newark earlier that year, following its purchase by RCA. The number of broadcasting stations in the US increased from 30 to 556 between January 1, 1922 and March 1, 1923. On August 1, RCA opened station WRC in Washington, DC.

The first broadcast of a national political

campaign was also credited to RCA, who covered the Republican and Democratic conventions in 1924. RCA broadcasting transmitters participated in a 24-station hook-up for the first broadcast of a Presidential inaugural ceremony. The March 4, 1925 swearing-in of Calvin Coolidge was heard by millions of Americans.

The first international re-broadcast heard in America was made possible by RCA on February 14, 1925. The London-based program was received at the coastal station at Belfast, ME, and relayed via short wave to WJZ, New York and WRC, Washington, where it was rebroadcast along the east coast.

Also in 1925, the first high-power transmitter for station WJZ was installed at Bound Brook, NJ. By the end of the year, RCA was developing a commanding lead in the US commercial radio broadcasting industry. RCA achieved yet another milestone in broadcasting in October 1926, when station WJZ provided the first direct broadcast of the World Series in baseball. Less than a month later RCA inaugurated the first nation-wide radio broadcast network: The National Broadcasting Company.

Radio Receiving Set and Tube Developments (1922-1925)

The Radio Corporation of America, as the selling agency for GE and Westinghouse radio apparatus, introduced its first home products catalog to the public in early 1922. In addition to the Westinghouse line (Types RA, DA, RC and Aeriola Junior), which debuted in 1921, the first GE sets were now being produced. These were the AR-1300 regenerative tuner, AA-1400 detector/amplifier and ER-753 receiver (Radiola I). GE also introduced the UV-199 and UV-201A radio receiving tubes in 1922. RCA augmented its receiver line with the Westinghouse Aeriola

2) This combination receiver (AR-1300, left) and detectoramplifier (AA-1400, right) was one of the first sets designed and manufactured by General Electric Company, Schenectady, NY for the Radio Corporation of America. The set, known as the "Radiola V" was featured in the first commercial catalog Radio Enters the Home in 1922. The set could also be purchased as two separate units. The AR-1300 sold for \$50; the AA-1400 for \$75.

Grand and Aeriola Senior models in 1922.

GE and Westinghouse were designing and manufacturing receiver sets and tubes independently of each other, resulting in a variety of non-standard items that RCA was responsible for selling. GE designed and manufactured its receiving sets and tubes at Schenectady. It also manufactured tubes at Nela Park (Cleveland), Harrison, NJ and later at Newark, NJ. Westinghouse designed and manufactured its receiving sets and tubes at East Pittsburgh. It also manufactured receivers at East Springfield, MA and tubes at Bloomfield, NJ and later at Indianapolis, IN.

RCA faced tremendous coordination problems as a result of these dispersed, competing operations. It was necessary to establish standardization committees for both receiving sets and tubes. RCA took on the challenge, setting up committees with representatives from all three companies.

RCA set up a test laboratory under Alfred Goldsmith at the City College of New York in

1) The "Aeriola Amplifier" model AC two-stage audio amplifier was built by Westinghouse and sold by RCA in 1922-23. It enabled increased reception range of the "Aeriola Senior." The price, including two WD-11A vacuum tubes, was \$68.





2) The RCA Technical and Test Department at 242nd Street, near Van Cortlandt Park, New York City was established in 1924. Alfred Goldsmith directed the operation, which included design coordination and testing of radio receiving sets and tubes and general radio research and development.

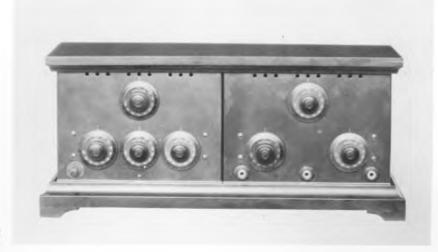
1922 to review designs submitted by GE and Westinghouse and to test and evaluate prototypes. The facility was quickly outgrown and by 1924 the RCA Technical and Test Department was established in a new building at Van Cortlandt Park in New York City. The department consisted of two groups. One, headed by Arthur Van Dyck, was responsible for design coordination and testing of both radio receiving sets and tubes. The other, headed by Julius Weinberger, was a radio research and development group.

Goldsmith, promoted to Director of the RCA Research Department, was in charge of the Van Cortlandt Park operation. Receiving set prototypes were submitted independently by GE and Westinghouse. Here they were tested and the results were reported back, either approving them for manufacture or recommending changes. The approved models were then built by both companies. Goldsmith coined the mark "Radiola," which was applied to the product line in 1923. The buying public could no longer easily distinguish a GE set from a Westinghouse set. Likewise, receiving tubes became known as "Radiotrons," with the selected designs being produced by both companies. Until this time, the Westinghouse WD-11 and WD-12 tubes were called "Aeriotrons." Marconi tubes were known as "VT's." Uniform tube design was essential, so that they could be interchangeable in any receiver. To accomplish these goals, the "Radiotron Standardization Committee" was set up in February 1924. However, due to diverse opinions among the various representatives of GE, Westinghouse and RCA, agreements were difficult to reach. Similar problems developed with the "Receiver Manufacturing and Design Committee." As a result, progress in product development and manufacturing was slow for the next several years.

- 3) The "Radiola II" or "AR-800" was an early portable model designed by General Electric. Introduced in 1923, it used two UV-199 Radiotron tubes. The mark "Radiola" was coined by Dr. Alfred N. Goldsmith in a note to David Sarnoff supporting his concept of a "Radio Music Box" for home entertainment.
- 4) The "Radiola VI," designed by General Electric, was a combination three-stage radio frequency amplifier, V.T. detector and two-stage audio frequency amplifier. It was sold by RCA in 1923 for \$162.50.



Radiola



City

R.E.D.

- 1) The "Radiola III," designed by Westinghouse and sold by RCA from 1924 to 1926, operated on two Radiotron WD-11 tubes.
- 2) The "Radiola Regenoflex," introduced by RCA in 1924, operated on four WD-11 Radiotrons and was supplied with an external loudspeaker. The set, excluding the six 1.5 volt dry cells and antenna, was \$206.
- 3) The "Radiola X," sold by RCA in 1924-25, contained an internal loudspeaker and four Radiotron WD-11 tubes. It was priced at \$150.



1

Several high-quality sets and tubes were designed and built by GE and Westinghouse and sold by RCA between 1923 and 1925. The Radiola II, IV, V and VI were introduced in 1923, as was the Radiola Grand. A significant change came in 1924 with the debut of the first superheterodyne set. Offering super sensitivity, selectivity and faithful reproduction, the Radiola Superheterodyne (portable) and Super VIII (console) helped to launch the "radio boom" in America. RCA had purchased the exclusive patent rights from Edwin H. Armstrong, who perfected the superheterodyne principle and demonstrated his first commercial model to Owen D. Young in March 1923. By December 1924 GE celebrated the 100,000th set off the production line at Schenectady. Other models introduced by RCA in 1924 were the Radiola Regenoflex, Radiola III, III-A, VII, VII-B and X. The first model designed for use with a standard phonograph, the Radiola IX, was also marketed. This was a significant move for RCA, leading to the contractual agreement with the Victor Talking Machine Company of Camden, NJ the following year for the sale of RCA Radiolas for inclusion in Victrolas. This arrangement provided the vehicle for RCA to subsequently acquire its first radio manufacturing facility in 1929.

In 1925, GE and Westinghouse manufactured the first sets adaptable to household (alternating) current. These were the Radiola 20, 25, 28 and 30.



3

These models operated from a household lighting circuit. The first electro-dynamic loud-speaker (No. 104) debuted that same year, revolutionizing broadcast reception in the home. It provided both louder sound and better frequency response. It was developed by Chester W. Rice and E.W. Kellogg at GE's Research Laboratory.

In conjunction with AT&T and its affiliate Western Electric, RCA began selling apparatus for recording and reproducing phonograph records electrically in 1925. One of the first buyers was, again, the Victor Talking Machine Company, who upgraded its Camden recording laboratory that year.





7) The "Radiola 26" was the first portable superheterodyne receiver offered by RCA. It contained six Raditron UV-199 tubes and was supplied with a home battery box which enabled the use of larger dry cells in a non-portable mode. A rotatable loop antenna was contained in the lid. It sold for \$225, from 1925-27.



4) The "Radiola Super VIII," a deluxe batterytype set introduced by RCA in 1924, contained six Radiotron UV-199 tubes, a loudspeaker and six standard dry cells. It sold for a staggering \$425.

5) The "Radiola Superheterodyne," with six Radiotron UV-199 tubes, was an ultrasensitive set introduced by RCA in 1924. The receiver, without tubes or loudspeaker, sold for \$220.

6) An October 31, 1925 ad in The Saturday Evening Post highlighted the new RCA Radiotrons and Radiola loudspeaker.



Communications Services (1926-1929): Formation of the Radiomarine Corporation of America and RCA Communications, Inc.

The ship-to-shore telegraph and trans-oceanic communications services of RCA expanded tremendously during the late 1920's, causing the formation of two separate companies to manage these operations. Several noteworthy activities highlighted this explosive period.

On January 1, 1926, for the first time in history, RCA maintained contact with a ship around the world. By applying short waves to maritime communications, messages were exchanged between New York and the SS Carinthia in Australian waters.

Commercial facsimile service between New York and London was inaugurated by RCA on May 1, 1926. Eleven days earlier, a radio photo of a check sent from London was received, honored and cashed in New York.

RCA opened radio communications circuits

to Brazil, May 3; French Indo-China, September 15; and Holland, November 1, 1926. This same year, AT&T established the first trans-atlantic radio telephone service through facilities leased from RCA.

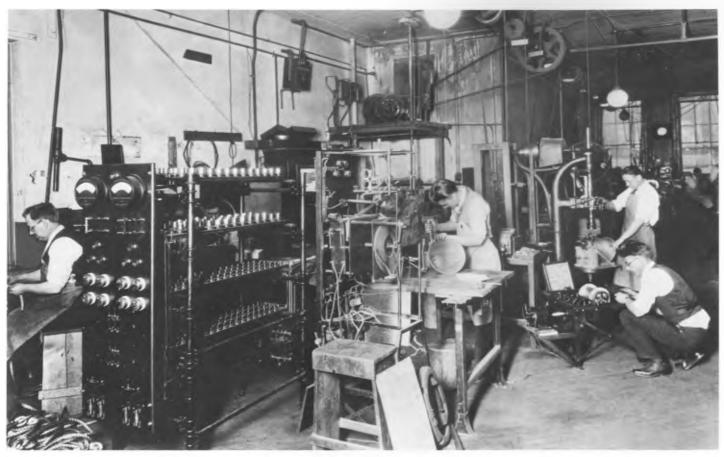
In 1927, RCA extended its communications services to the aviation industry by collecting ship-based weather reports at no charge for the US Weather Bureau. The reports enabled the Bureau to compile comprehensive weather maps of the North Atlantic prior to the non-stop trans-atlantic flights by Lindbergh and Byrd. Lindbergh's *Spirit of St. Louis* was not equipped with radio for the first historic crossing, but Byrd's *America* was so equipped. Byrd maintained contact with RCA's Chatham, MA station throughout most of his flight to France.

The following radio communications circuits were opened by RCA in 1927: Dutch West Indies, June 21 (later replaced by circuit to Curacao); Philippines, June 27; Hawaii-Philip-

1) After receiving an overseas telegraph message, an operator at the RCA Communications, Inc. station in New York is shown here preparing a "Radiogram," circa 1929. RCA Communications, Inc. was organized on January 3, 1929 as a subsidiary company of RCA to operate and manage the expanding international communications service.







2

pines, July 1; Dutch Guiana, August 9; Colombia, August 12; Germany-Philippines, August 15; Venezuela, August 18; Belgium, October 3; Puerto Rico, October 10; Dutch East Indies-Philippines, October 17, China (Hong Kong via Manila), October 18; Japan-Philippines, October 20; Indo-China-Philippines, November 1; Turkey, December 10.

Due to the steady growth in maritime radio communications activities, RCA organized the Radiomarine Corporation of America on December 31, 1927 to manage and operate this business. Headquartered at 66 Broad Street in New York City, Radiomarine consisted of five regional divisions by 1930: Eastern (New York, NY), Great Lakes (Cleveland, OH), Pacific Coast (San Francisco, CA), Gulf (New Orleans, LA) and New England (Boston, MA).

In 1928, RCA developed a system for short wave international radio telegraph reception for commercial applications. Installations of short wave directional systems began that year.

RCA opened radio communications circuits as follows in 1928: Siam-Philippines, January 13; Venezuela (Maracaibo), January 22; China (Shangai via Philippines), February 21; Canada (Montreal), March 10; Portugal, April 2; Australia (via Montreal), June 15; Dutch West Indies (Curacao), August 4; Liberia, September 1; Cuba, December 4.

As a result of this rapid expansion in worldwide radio telegraph service, RCA Communications, Inc. was organized on January 3, 1929 to manage and operate this international operation.

A subsidiary company of RCA, it was headquartered at 66 Broad Street in New York City and consisted of a Traffic Department, Commercial Department, Engineering Department, an Atlantic Division and a Pacific Division. This new organization demonstrated its capability of rapidly and efficiently handling increased transatlantic traffic on November 18, 1929, when it assumed a large volume of cable business following an earthquake that snapped twelve cables on the floor of the North Atlantic Ocean.

In 1929, RCA Communications, Inc. opened the following radio communications circuits: Hawaii-Fiji Islands, May 1; New York-San Francisco, May 15; Spain, August 1; New Orleans-Puerto Rico, August 12; Syria, September 3; Costa Rica, September 3. 2) Communications equipment assembly at the Radiomarine Corporation of America in New York City, circa 1927. Radiomarine was established by RCA on December 31, 1927 to manage and operate the growing activities in maritime radio communications. Courtesy: GE Government Services.

The National Broadcasting Company: Formation and Early Activities (1926-1929)

Between 1922 and 1924, the number of radio broadcast stations in the United States increased from 600 to 1400. Most were operated as promotional sidelines of other businesses or hobbies. Program schedules were inconsistent and broadcasts were mainly not for entertainment. The early novelty quickly wore off. The 1400 stations in 1924 dwindled to 620 by 1926.

David Sarnoff recognized the need for a regular, professional program service as early as 1922, when he suggested a nationwide capability via networking.

RCA, GE and Westinghouse took action to make the vision a reality. On July 1, 1926, they purchased rival station WEAF (on lower Broadway) from AT&T for \$1 million. This became the key station for the planned network. On September 9, the National Broadcasting Company, Inc. was organized as a subsidiary of RCA. The joint venture was owned by RCA, GE and Westinghouse on a 50/30/20 percent ratio, respectively.

A newspaper ad on September 13 announced the plan and its purpose to the public. It stated that RCA had purchased WEAF and was forming NBC "to provide the best programs available in the United States" and that NBC "will not only broadcast these programs through station WEAF, but it will make them available to other broadcasting stations throughout the country so far as it may be practicable to do so, and they may desire to take them. It is hoped that every event of national importance may be broadcast throughout the United States."

NBC took over operation of RCA stations WJZ, New York and WRC, Washington, DC on September 15.

On the evening of November 15, 1926, one thousand guests in full evening dress gathered in the Grand Ballroom of the old Waldorf-Astoria Hotel at 34th Street and Fifth Avenue in New York City for a memorable event: the inaugural radio program of NBC. More than two million homes, from Portland, Maine to Washington, DC, and as far west as Kansas City, sat eagerly by their radios. This historic broadcast was networked through 25 stations in 21 cities.

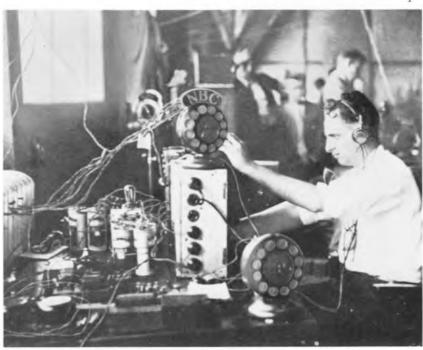
The four-hour and twenty-five minute program opened with a speech by Merlin Hall Aylesworth, president of NBC. He was followed by Milton Cross, who introduced singer Mary Garden in Chicago. Garden sang "Annie Laurie" and "My Little Gray Home in the West." She was followed by some of the finest talent of the mid-

twenties: the New York Philharmonic Orchestra, conducted by Walter Damrosch; the New York Oratorio Society, conducted by Albert Stoessel; Edwin Franko Goldman and his Band; the comedy team of Weber and Fields; Will Rogers, by remote broadcast from Independence, Kansas; and the dance orchestras of Vincent Lopez, Paul Whiteman, George Olsen and Ben Bernie. This spectacular event combined music, comedy and monologue in a single broadcast. America's first radio network was born.

The initial 25 stations, headed by WEAF, constituted the "Red" network. Two months later, to provide a wider variety of programming to a hungry public, the six-station "Blue" Network was added with WJZ as the lead station. A Pacific Coast network of seven stations was also added in early 1927. The Pacific stations became the "Orange" and "Gold" networks.

NBC achieved the nation's first coast-to-coast network program broadcast by wire on January 1, 1927, when Graham McNamee announced the Rose Bowl game from Pasadena, CA. NBC engineers demonstrated their flexibility, ingenuity and dedication in covering special events. An example was the 1927 reception in Washington, DC for Charles A. Lindbergh upon his arrival back from his historic trans-atlantic flight to Paris. Graham McNamee, while standing on a cruiser in the Navy Yard, reported Lindbergh's landing. Milton Cross described the official reception from up in the dome of the Capitol. John Daniel reported the parade along Pennsylva-

- 1) An early radio broadcast by the National Broadcasting Company, circa 1927.
- The musical notes of the famous NBC chimes -G, E, C- stand for General Electric Company.
- 3) The historic first network broadcast by NBC featured a monologue by actor Will Rogers live from Kansas City. The broadcast reached over 2 million homes.
- 4) Announcer Milton Cross launched NBC's historic first network broadcast from New York on November 15, 1926, with his introduction of singer Mary Garden in Chicago.
- The team of Weber and Fields provided the sole comedy act for NBC's first network broadcast.



nia Avenue from the Treasury Building. And Phillips Carlin closed the broadcast from the top of the Washington Monument.

The first regular musical program, inaugurated on the combined WEAF-WJZ network on October 26, 1928, was NBC's "Music Appreciation Hour." Conducted by Walter Damrosch, the program reached millions of school children throughout the nation.

Most regular programs were broadcast from the WEAF studios at this time. Centralized network studios were then constructed at 711 Fifth Avenue, known as the National Broadcasting Company Building. Here NBC remained until 1933, when it moved to the newly-completed RCA Building at 30 Rockefeller Plaza. In recognition of RCA's achievements, the Rockefeller interests named their new complex "Radio City".

A final noteworthy achievement by RCA and NBC during this early period of radio broadcasting occurred on Christmas Day, 1929. The combined team of NBC and RCA Communications, Inc. produced the first important exchange of radio programs between the United States and Europe. Radio for entertainment had crossed the Atlantic.











Radio Sets, Tubes and Transmitters (1926-1929)

With the advent of electrical sound recording and reproduction, RCA, GE and Westinghouse continued to achieve technical milestones in developing radio receivers, transmitters and tubes during the late 1920's.

The Radiola 20, 25 and 28, the first sets adaptable to alternating current (AC), were manufactured for sale to various phonograph companies beginning in 1926. These sets were integrated into phonograph cabinets to produce radio-phonograph combinations.

The first fully AC-operated set using AC tubes was the Radiola 17, first marketed by RCA in 1927. GE and Westinghouse manufactured the first AC tubes, eliminating the need for batteries, in 1927. The tubes were made available to the entire industry within two years.

In 1928, RCA introduced advanced models of superheterodyne receivers with automatic volume control. They used dynamic loudspeakers and AC tubes.

The first 50-kilowatt broadcast transmitters, developed at GE, Schenectady in 1927, were marketed by RCA in 1928.

Under the direction of Ernst Alexanderson, GE developed a 24-line mechanical television system in 1927. Its station WGY in Schenectady, NY inauguarated television broadcasting the following year.

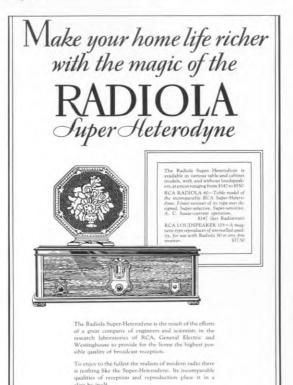
1

2



Screen grid tubes, which permitted greater sensitivity with a smaller number of tubes, were also developed by GE in 1927.

Broadcast transmitters were being developed for field use in 1929. On March 4, a transmitter mounted in an airplane broadcast a reporter's comments on President Hoover's inauguration. A "portable" transmitter, requiring two to carry it, was first used by NBC on August 4. On August 12, a parachutist, carrying a knapsack transmitter designed by NBC engineers, commented on his impressions of the world after leaping from an airplane.



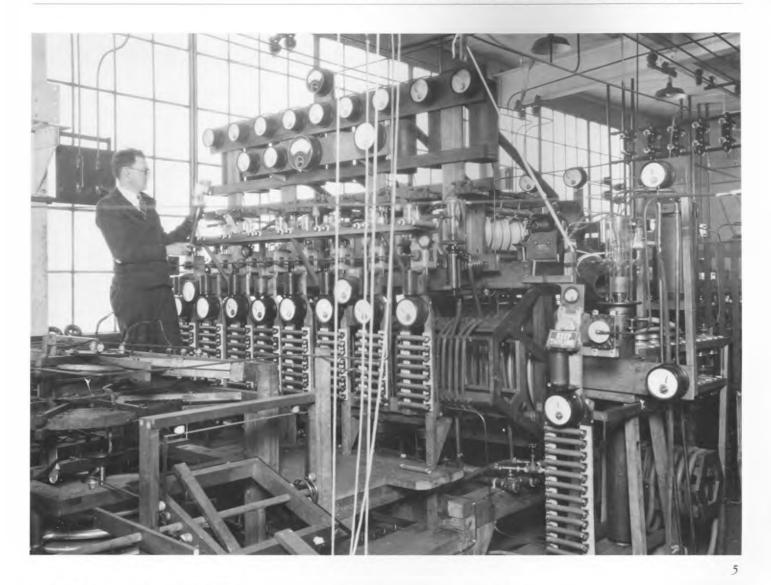
- 1) The "Radiola 17," introduced in 1927, was the first fully AC-operated radio receiver. It contained six AC tubes and a rectifier, operating on a tuned radio frequency principle.
- 2) The "Radiola 18" was a fully AC-operated receiver sold by RCA in 1928-29.
- 3) The "Radiola 60" Superheterodyne was introduced in 1928 and sold by RCA for \$147.
- 4) The "UX-222" filament-type Radiotron receiving tube, announced by GE in November 1927, was the result of work by Albert Hull and Irving Langmuir to develop a process to reduce excessive noise in the Superheterodyne receiver.

3





RADIOL



Radio Patent Licensing (1926-1929)

The years 1923-1926 were marked by flourishing competition in radio receiver and parts manufacturing. Magnavox, Zenith, Atwater-Kent, Paragon, Freed-Eisemann and many others had entered the radio manufacturing business. It was estimated that, in 1923, there were over 200 set makers and 5,000 parts makers. Many of RCA's competitors were not even in the radio business prior to the boom in the early 1920's. Crosley built auto equipments; Atwater-Kent made magnetos; Sparks-Withington (Spartan Radio) made auto horns; Philadelphia Storage Battery (Philco) and Eveready manufactured storage batteries. Yet these and many other companies were quite successful in a short time.

At the time there were large and quick profits in the business, and patent infringement was widespread. RCA, GE and Westinghouse held most of the critical patents, and they found many companies manufacturing radios using their technologies without permission.

As a result, in November 1926, RCA, GE and Westinghouse decided to license their radio patents to competitors rather than fight them. The original agreement required payment of 7.5 percent of the manufacturer's value of the complete set to RCA. Licenses for tubes were granted by 1929.

By the late 1920's, over 90 percent of radios in the United States were manufactured with RCA's permission. In 1928-29, the public purchased 7.5 million radios, investing \$1.5 billion in sets and parts. The RCA/GE/Westinghouse group collected \$282 million and made almost \$36 million in net income in these two years, which was considerably more than the total profits of previous years. It was a rightful return for the huge investments made by RCA, GE and Westinghouse in research, engineering and patent purchases in the early 1920's.

5) Experimental 50kilowatt broadcast transmitter at GE station WGY, Schenectady, NY, March 21, 1927. Courtesy: Loren F. Jones.

RCA Photophone and RKO: Formation and Early Activities (1927-1929)

The first expansion by RCA, GE and Westinghouse beyond the fields of communications services, radio broadcasting and radio manufacturing was in sound recording for motion pictures. The 1925 pioneering efforts by Warner Brothers' Vitaphone Corporation were a success. The Vitaphone technique involved pre-recording musical disks, which were carefully synchronized to match the silent movie. The public reacted enthusiastically to the first "talkie"-Al Jolson starring in the 1927 film The Jazz Singer. But the audience only heard the songs; the rest of the movie was silent. It was also difficult to maintain synchronization between the film and the accompanying musical disk.

GE began research in sound on film as early as 1919, when Charles A. Hoxie, at GE's Schenectady Laboratory, began work on a new high-speed recorder for trans-atlantic radio signals. His experiments led to the development of a sound-on-film recording device known as the "Pallophotophone." In September 1927, GE gave the first theatre demonstration of a talking movie with both picture and sound recorded and synchronized on the same piece of film. This was a superior method to that of Vitaphone, since the sound could not fall out of sync with the film. The sound could only jump if the film was spliced. Improvements to the Pallophotophone led to the introduction of the "Photophone" by GE in early 1928. On April 4, RCA Photophone, Inc. was organized for further development and distribution of GE's sound motion picture recording and projection equipment. It was headquartered at 411 Fifth Avenue in New York City.

To succeed in this new venture, RCA Photophone needed to establish an alliance with the theatre and motion picture industry.

By late 1928, an agreement was made with Keith-Albee-Orpheum Corporation, a chain of 200 theatres, and its affiliate, FBO (Film Booking Office) Productions, Inc. Keith-Albee-Orpheum had been mainly a vaudeville business, which was suffering financially and doomed by the arrival of the "talkies." Keith-Albee-Orpheum became Radio-Keith-Orpheum (RKO), and FBO Productions became RKO Productions (renamed Radio Pictures, Inc., by 1929). RKO gave RCA 500,000 shares of a specially-created Class B stock (20 percent interest). In return, RCA gave RKO the right to use the Photophone and agreed to advertise

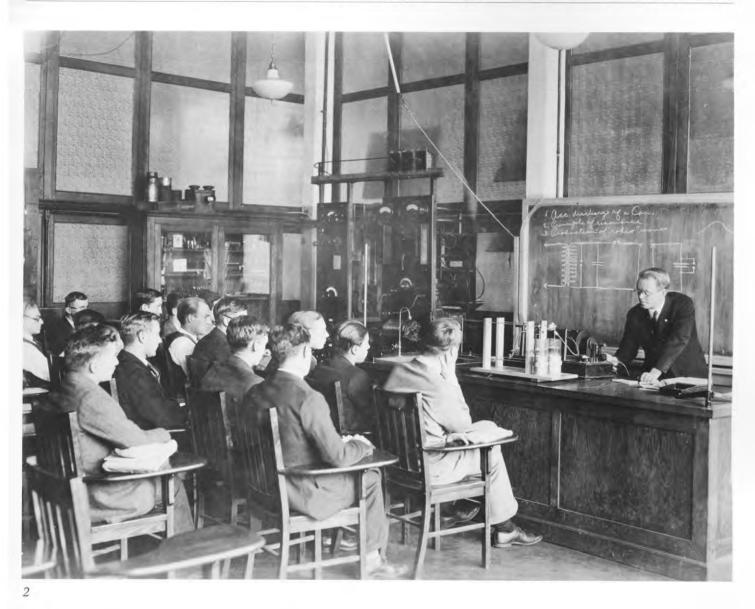
RKO through the National Broadcasting Company. In essence, RCA gained a market for Photophone equipment without any cash investment. RCA engineers at Van Cortlandt Park began research to design and develop acoustic equipment needed for the 200 RKO theatres.

By 1929, the ailing RKO had recovered from its losses and made \$1.7 million. That same year, RCA Photophone demonstrated its first experimental sound movie apparatus for the home, using 16-millimeter standard film.

By the end of 1929, RCA Photophone had contracts with 565 theatres in the United States and 361 theatres in 23 countries abroad for projection equipment manufacturing and installation. Contracts were in place with eight domestic motion picture studios for recording equipment manufacturing and installation. Similar contracts were signed with companies in England, France and Italy. RCA Photophone had established a strong position in both the domestic and international motion picture industry in only two short years.

- 1) Jackie Coogan speaking into the Pallophotophone, a predecessor to the Photophone. The inventer, C.A. Hoxie, is shown here instructing the child star, February 21, 1923. Courtesy: Hall of History Foundation.
- 2) Cornelius Peterson teaching the principles of radio at RCA Institutes, Newark, NJ, circa 1930. Courtesy: GE Government Services.
- 3) Morse code training at RCA Institutes, 75 Varick Street, New York City, 1933.





RCA Institutes, Inc.

To provide technical training in telegraph operations and radio equipment repair, RCA established RCA Institutes, Inc. as a whollyowned subsidiary. The business, established in 1909 by the Marconi Wireless Telegraph Company of America, was the oldest radio school in the United States. Acquired by RCA after its formation in 1919, the school was headquartered at 75 Varick Street, New York City, with established branches in Philadelphia, PA; Newark, NJ; Boston, MA; and Baltimore, MD. RCA Institutes, the pioneer in radio technical training, grew to become one of the foremost television and electronics schools in the United States.



Vladimir Zworykin and Early Television Developments (1923-1929)

As early as April 3, 1923, David Sarnoff foresaw the possibility of television as a parallel service of radio broadcasting. In a report to the RCA Board of Directors, he wrote "I believe that television, which is the technical name for seeing as well as hearing by radio, will come to pass in due course... It may be that every broadcast receiver for home use will be equipped with a television adjunct by which the instrument will make it possible for those at home to see as well as hear what is going on at the broadcast station."

The pioneer responsible for making the dream a reality was Dr. Vladimir K. Zworykin. His conception of the first practical television camera tube, the "Iconoscope," and his development of the "Kinescope" picture tube formed the basis for nearly all important subsequent advances in the field.

Born in Mourom, Russia on July 30, 1889, Zworykin attended the Petrograd Institute of Technology and received his electrical engineering degree in 1912. It was here that Zworykin studied under Professor Boris Rosing. As early as 1906, Rosing believed that the solution to practical television was to be found, not in mechanical systems, but in the use of cathode ray tubes. Zworykin took an immediate interest in developing this idea. In 1912, he entered the College de France in Paris, where he studied xrays under the noted scientist Professor Paul Langevin. He returned to Russia to serve in the Army Signal Corps during World War I. After the war, Zworykin came to the United States and joined the research laboratory of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, PA in 1920, where he began development of the "Iconoscope."

On December 29, 1923, Zworykin applied for the patent on the Iconoscope, television's electronic "eye." He continued research in photoelectric emission and receiving tubes for the next six years. By 1925, steps were being taken in the laboratories to test the possibility of television as a service to the public. In 1928 the first experimental television station, W2XBS, was licensed to RCA. A 250-watt transmitter and the station were located at 411 Fifth Avenue, New York City.

On November 18, 1929, Zworykin demonstrated an all-electronic television receiver using the "Kinescope," or picture tube. He transferred to Camden, NJ that year, continuing his research as an employee of RCA at the newly-acquired facilities of the Victor Talking Machine Company. Here, accompanied by several of his colleagues from Westinghouse, Zworykin headed research in electron optics and photoelectric cells, further developing the Iconoscope and Kinescope for practical applications.



- 1) Dr. Vladimir K. Zworykin, holding the Kinescope, or cathode ray receiving tube, which he invented and first demonstrated in 1929.
- 2) Dr. Zworykin, the "Father of Television," was one of several Westinghouse engineers who transferred to the new RCA research laboratory in Camden, NJ in 1929-30. Pictured here at Westinghouse, East Pittsburgh, PA in 1929 were (l-r. sitting): R.W. Carlisle, K.G. Gillette, Dr. Zworykin, R.C. Ballard. G. Oglobinski, H.A. Vance; (l-r, standing): W.R. Koch, G.L. Beers, J.C. Batchelor, F. Cone, S. Currier.



From RCA to RCA Victor: Consolidation Begins at Camden (1929-1930)

By 1927, GE, Westinghouse and RCA began to address the issue of consolidation of the various research, development and manufacturing functions at a single location. All three companies agreed that consolidation was necessary to remain competitive and profitable in the radio market. The favored location was Camden, New Jersey, home of the Victor Talking Machine Company. RCA had been producing radio equipment for Victor since 1925 and was keenly interested in acquiring its manufacturing facilities.

On March 15, 1929, RCA gained controlling stock interest in Victor. Since the stock market had been shooting up steadily, a heavy price was paid for the Victor Company. RCA's purchase totaled \$154 million, including stock and cash payments. Only two years earlier, the public paid \$53 million for Victor. But it was worth the price paid by RCA, since it now could begin to consolidate and coordinate radio research and manufacturing operations at a single location.

The following month, two new corporations were organized for the Camden-based business: The Audio Vision Appliance (AVA) Company and the Radio-victor Corporation of America. AVA, a New Jersey corporation organized on April 29, 1929, was the manufacturing company jointly operated by GE and Westinghouse on the established 60-40 ratio. Radio-victor, a Maryland corporation, was organized on April 25, 1929 as a wholly-owned subsidiary of RCA. It was defined as the sole sales agency for all Victor products: Victrolas, records, synchronized motion picture records, combination radio-phonographs and radio receivers.

On October 4, 1929, the Radio Corporation of America, General Electric Company and Westinghouse Electric and Manufacturing Company agreed in principle to unify the research, engineering, manufacturing and selling activities of the three companies in connection with radio receiving sets and accessories, phonographs and vacuum tubes. The plan was to consolidate these activities into a single organization, which would allow for greater flexibility, efficiency and economy in research and manufacturing. This arrangement would also mean a quicker response to the needs of the customers.

On December 26, 1929, the RCA Victor Company, Inc. was organized under the laws of the state of Maryland. A wholly-owned subsidiary of RCA, it began doing business on January 1, 1930. It took over the manufacturing operations of AVA, the selling operations of

Radio-victor and the remaining assets of the Victor Talking Machine Company.

The Victor assets included the manufacturing plants in Camden, NJ; Oakland, CA and Argentina; all stock of the Victor Talking Machine Company of Canada, Ltd., Victor Talking Machine Company of Brazil and Victor Talking Machine Company of Chile; substantial stock interests in Victor Talking Machine Company of Japan, Ltd. and in the Gramophone Company, Ltd. of Great Britain. AVA and Radio-victor were formally dissolved on November 7, 1930 and July 14, 1931, respectively.

RCA also organized the RCA Radiotron Company, Inc. as a subsidiary company on December 26, 1929. Also beginning operations on January 1, 1930, RCA Radiotron consisted of the tube manufacturing plants of GE at Harrison, NJ and Westinghouse at Indianapolis, IN.

Radio research activities previously conducted at RCA (Van Cortlandt Park, NY), GE (Schenectady, NY) and Westinghouse (East Pittsburgh, PA) were transferred to the RCA Victor Company at Camden, NJ. Key engineers from all three locations moved to Camden and those from GE and Westinghouse became RCA employees. A new, centralized research laboratory was established in Buildings #5, 6 and 7. Broadcast transmitter research and manufacturing was also moved from GE Schenectady to RCA Camden.

Vacuum tube research and manufacturing operations at GE Schenectady and Westinghouse East Pittsburgh were relocated to RCA Harrison.

The three-way settlement was reached in April 1930. RCA's common stock issue was doubled and 6,500,000 shares each were accepted by GE and Westinghouse. The three companies were now, for the first time, partners in research and manufacturing.

Financial Summary (1919-1929)

When RCA was formed in 1919, it began operations with 457 employees. At the end of its first full year of operation in 1920, total sales of products and services were \$2 million. By 1928, the number of employees increased to over 7000 and sales topped the \$100 million mark. Following the start of consolidation at Camden, when GE and Westinghouse personnel were becoming RCA employees, RCA 's work force increased to 18,000 in 1929. Total sales in 1929 were \$182 million.

In the course of ten years, RCA had become an industry leader in products and services for international and maritime communications, radio broadcasting, sound motion pictures and home entertainment.



Chapter 5

RCA Victor: From Radio to Television (1930-1939)

"Today we are on the eve of launching a new industry..."

— David Sarnoff President, Radio Corporation of America Dedication of RCA Exhibit Building, New York World's Fair, April 20, 1939

ith these words, RCA President David Sarnoff introduced the wonder of television to the American public at the 1939 New York World's Fair. This phenomenal achievement of adding sight to sound would have one of the greatest impacts on twentieth-century American society.

This historic event was the result of a decade of pioneering efforts by the engineers, scientists, program directors, technicians, broadcasters and other support personnel of the Radio Corporation of America. The driving force was the talented research and engineering team at RCA Camden, brought together in 1930 from the various laboratories of GE, Westinghouse and RCA. The combination of these three communications pioneers in a centralized research and manufacturing facility created a company that led the radio and television industry throughout the 1930's and beyond. This is the story of the second twentieth-century communications pioneer in Camden, New Jersey—RCA.

"Radio Headquarters," Camden, NJ

The RCA Victor Company's activities in Camden, NJ encompassed not only the manufacture and sale of home radio receivers, but research, engineering and production in all branches of radio broadcasting and entertainment. The company was organized into two functional departments (engineering and manufacturing) and two product divisions (Victor Division and Radiola & Engineering Products Division), combining personnel from RCA, GE, Westinghouse and the Victor Talking Machine Company. By pooling the unique talents of these personnel, the RCA Victor Company developed a highly diversified product line. From Radiolas to Victrolas; from broadcast transmitters to directional antennas; from Photophone

Radio receiver manufacturing at the RCA Victor Company, Inc., Camden, NJ in 1930. RCA Camden led the industry in both radio and television technology. projectors to Red Seal records, RCA Victor's quality products were known throughout the radio broadcasting and entertainment industry. The Camden Plant became more commonly known as "Radio Headquarters" throughout the 1930's.

"His Master's Voice" and RCA

With the acquisition of the Victor Talking Machine Company, RCA gained not only a large manufacturing facility, but a world-renown business and trademark. RCA had acquired the Camden plant, as well as the talented people responsible for Victrolas and Red Seal records. The words "Victor" and "His Master's Voice" became associated with RCA and its products. A new trademark was started by the RCA Victor Company on May 31, 1932. The RCA monogram was joined by Nipper and the Gramophone. This powerful combination became the symbol of quality for RCA Victor Photophones, records, broadcast equipment and other consumer products in the 1930's. RCA and Nipper had begun a relationship which would last for six decades.

Registered Apr. 25, 1933

Trade-Mark 302,712

UNITED STATES PATENT OFFICE

BCA VICTOR COMPANY, INC., OF CAMDEN, NEW JERSEY

ACT OF TERRUARY SO, 1908

Application fiel June 17, 1932. Sectal No. 198,074.



STATEMENT

To dil selom 28 may concern.

Be it known that the BCA Victor Company, Inc., a corporation organized and entiting under and by virtue of the laws of the State of Maryland, and located in the cit of Camden, county of Camden, Camden, State of West Camden, Camden, State of Vest Camden, State of Vest Camden, State of Vest Camden, State of Vest Camden, State of Republic Camden, State of Camden, Camden, State of Camden, Ca

DUSTRIAL PURPOSES, EDUCATIONAL PURPOSES, AND ENTER-TAINMENT PURPOSES, PARTS THEREOF AND ACCESSORIES THEREOF AND ACCESSORIES PURPOSED FOR ACCESSORIES THEREOF AND ACCESSORIES PURPOSED FOR ACCESSORIES AND FOR GUIDING DEVICES, FILM MAGAZINES, FILM DUPLICATING APPARATUS, CAMERAS, CURRENT AND OR VOLTAGE INDICATING DE-FADERS, in Class 20 Ocasuring and scentific appliances.

The trade mark has been continuously used in the business of the said corporation since

May 31, 1932. The trade-mark is usually applied or affixed to the goods, or to the packages conparing the same, by imprinting, embessing, sugraving, or etching, or by placing thereon metallic plains, a printed label; a decalemanta or the like, upon which the said trademark is shown.

RCA VICTOR COMPANY, INC., By FRANCIS S. EANE, 1) The combination of the RCA monogram and "His Master's Voice" became the registered trademark of the RCA Victor Company on April 25, 1933.

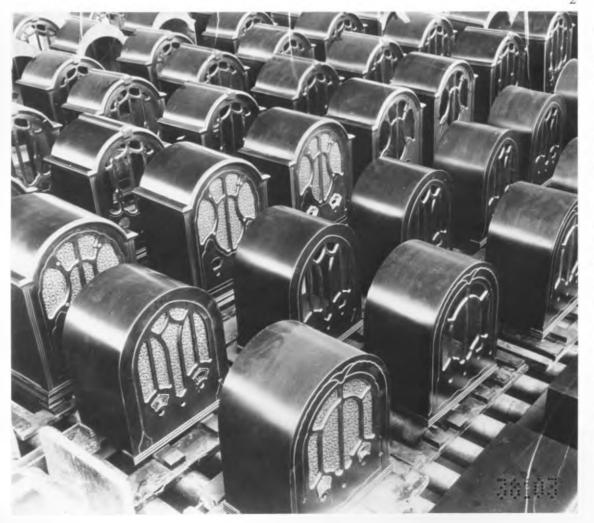
2) Table-top radio cabinets, manufactured under both General Electric and RCA brand names, rolling off the assembly line at the RCA Victor Company, Camden, May 1934.

3) The first directors of the RCA Victor Company, Inc., 1930. The headquarters was initially located in New York City, but soon moved to Camden, NJ.

Overleaf:

1) The RCA Victor
Engineering Department, in 1930, headed
by W.R.G. Baker
(formerly GE),
consisted of top talent
brought to Camden
and Harrison, NJ from
the Research Laboratories of GE
(Schenectady, NY),
Westinghouse (East
Pittsburgh, PA) and
RCA (Van Cortlandt
Park, NY).

2) The Manufacturing Department for the RCA Victor Company Inc., 1930.









Camden Plant Expansion (1930)

Despite the arrival of the Great Depression, RCA invested considerable amounts in 1930 to improve and expand the Camden plant. Expansion was necessary to accommodate radio manufacturing, which was currently confined to spaces in Buildings #10 and #13. RCA Victor spent \$5 million, beginning that year, in various upgrades. The major project was construction of Building #3, completed in June 1930. The two-story addition on Cooper Street housed component part manufacturing, incoming stock, a warehouse, hospital and dining area.

To provide further economy in manufacturing, overhead conveyor systems were constructed. One, connecting the cabinet factory (#17D) to the final test area (#24), fed completed phonograph and radio instruments automatically. The other, connecting the radio chassis assembly area (#10) to the final test area (#24), sent completed radio sets down for testing. As a result of these improvements, the radio sets were being produced at the rate of nine thousand a day (2.7 million a year) by 1932.







- 1) Northwest view of construction site for the new RCA Victor radio manufacturing building on Cooper Street, Camden, NJ, March 17, 1930.
- 2) Same view on May 5, 1930, with construction nearing completion.
- 3) Northeast view of Building #3 upon completion, June 1930.
- 4) Aerial view, looking northeast, of the RCA Victor Company, Inc. of Camden, NJ, August 1930.





1) The Victor Division of the RCA Victor Company, 1930. This group, consisting largely of former employees of the Victor Talking Machine Company, was responsible for managing the Victor product line: sound recording, Victor records, Orthophonic Victrolas and Victor radios with Electrolas.

Product Developments(1930-1934)

The consolidation of research activities in home instruments, broadcasting, sound motion picture equipment and specialized communications gear at Camden allowed RCA Victor to rapidly develop new and innovative products.

Significant achievements in 1930 included the first push button remote control tuning radio set and the first radio-phonograph combination with a home recording device. Camden engineers also designed and built the lightest and most compact combination radio telephone and radio telegraph transmitter ever constructed up to that time for use in commercial aircraft.

A new line of low-cost, quality broadcast receiving instruments and advanced radio-phono combinations were introduced in 1931. The world's first long-playing record was demonstrated on September 18, 1931. Still in an experimental stage, its sound reproduction quality at 33 1/3 rpm could not match the 78 rpm record. The RCA Victor LP of 1931 did not become a commercial hit.

Another milestone of 1931 was the development of the electric carillon. (The

carillon is a set of fixed tuned bells sounded by hammers and controlled from a keyboard.)

RCA Photophone, which moved to Camden in 1931-1932, developed a new noiseless system of sound recording for the motion picture industry in 1931.

The ribbon microphone was another pioneering achievement at RCA Camden in 1931. Developed by acoustic engineer Harry Olson, it was dubbed the "velocity" microphone by sales engineer Ted Smith. The velocity microphone became the standard of broadcasting stations.

RCA Camden achievements in 1932 began in January with the first installation of "Class B" modulation equipment for a Philadelphia radio station. That same month, the first commercial automobile radios were introduced. A portable self-contained UHF transmitter was announced on September 27, 1932. Small and light enough to be carried in a knapsack, the unit was used by NBC "Roving Reporters" in the field, as well as by soldiers of the US Army in scouting operations. The first uni-directional microphone, another major advance in broadcasting equipment, was also developed in 1932.

2) The Victrola product line of the RCA Victor Company in 1930 consisted of models previously sold by the Victor Talking Machine Company in the late 1920's.



VICTROLA
SUMBER ONB-SEVENTY
Semi-portable model. Cabinet, mahogany venered with maple



ORTHOPHONIC VICTROLA
MUMBER FOUR-THERE
An ideal instrument for the small home. Console type Sheratm
Colonial Design. Mahorany sourced, two-tone, blended finish.



ORTHOPHONIC VICTROLA
NUMBER FOUR-SEVEN
A small-sized Victrola of equititie design and sturdy appearance.
Cabinet, Italian Remaissance style, mahogany concret, blended



MUMBER BUCK-TWENTY

A beautiful cabinet of classical English design. Venues blended antique, malogany finish.



NUMBER POUR-PORTY
A beautiful cabiner, console type, led opening in the con
Spanish style cabiner, malogony wintered, blended finish.



ORTHOPHONIC VICTROLA
NUMBER RIGHT-TWELVE
Cabinet in French Renational visits, walnut venered, blend



MUMBER BILLET TRIBET FIVE

Cabinst walnut senered, untique finish. Receptacles for album
provided at sides. Lid opens only in center.



ORTHOPHONIC VICTROLA
NUMBER RIGHT-NINE
A salarful subject in sub-vener. Baronial sub-finish with



ORTHOPHONIC VICTROLA
NUMBER SIGNT-SHORT
Designed especially for school are. Out owner, Barmial out
finish with rolor panels in blue at top and buttom of down.
Controlled wheel to active in movests. Short for allowed.



rice, less Radiotrons, \$142.50.



Model 82

offers all the features of addition, TONE-GOLOR

Price, less Radiotrons, \$179.50.



Model 86

Price, including Home-Recording microplesample blank records, \$285, less Radi



Screen - Grid Model 48

Price, less Radiotrons, \$112.50.

Hear RCA Victor's new 30-Minute Records

on this Amazing Radio Phonograph

A Whole Symphony on One Record! Almost Two Hours of unrepeated music through automatic record changing! Plus radio as you have never heard it before

They're the sensation of the musical season! Victor's new Program Transscriptions-records of standard size that play nearly four times as long as present types!

On this instrument, these records re-make home entertainment! You can listen to radio with tone never before matched-or you can make up your own programs with almost unlimited diversity. You can listen, if you like, to almost two hours of music, through records changed automatically-played one after the other without a move on your part!

All this from an instrument that costs no more than a high grade radio once cost! An'instrument featuring RCA-Victor's exclusive new 10point Tone System. An instrument that ushers in a new era in music-inthe home! See this radio phonograph now. A small down payment and convenient terms covers the cost.



COMPLETE

The 10 Points of RCA Victor's New Synchronized Tone System

- 1 Super-Efficient RCA Victor Super-Heterodyne Circuit.
- 2 Shock-Proof, Rubber Mounted Chassis.
- 3 Continuous Band-Pass Variable Tone Control. 8 Perfect nization

- 5 Noise Eliminating Power 10 New R with P
- 6 New RCA Victor Au

- 9 Over Spea



1) RCA Victor's finest and most complete automatic radio-phonograph combination was the RAE-79, introduced in 1931. It featured a superheterodyne receiver, electric phonograph, (capable of playing both 78 and 33 1/3 rpm records), an automatic record changer, home recording mechanism and remote control. Encased in a solid walnut armoire cabinet, the RAE-79 was a new world masterpiece in an old world setting.

D E A L E R

- 2) The RCA Victor Company's 1930 Radiola product line. Courtesy: Ron McHugh, GE GCSD.
- 3) A September 30, 1931 ad announcing the "revolutionary" RCA Victor model RAE-26 radio phonograph, which played the world's first 33 1/3 rpm records. Invented by RCA Victor, the 33 1/3 was introduced too early to the 78 rpm-buying public. The reproduction quality of the experimental 33 1/3 was inferior to the 78, and the campaign was soon cancelled. The perfected 33 1/3 LP was introduced seventeen years later by Columbia Records.
- 4) Handcrafting radio cabinets in Building #17, RCA Victor Company, Camden, NJ, May 1934.
- 5) The model #126-B, a six-tube superheterodyne, was among the RCA Victor "Blue Ribbon Aircell" battery-operated sets introduced in 1933.
- 6) The RCA Victor "Portette" model #116, introduced in 1933, was an "arm rest" portable radio engineered for use in both the automobile and the home.
- 7) The RCA Victor "Globe Trotter" radio, an allwave, eight-tube superheterodyne, was introduced in late 1933.







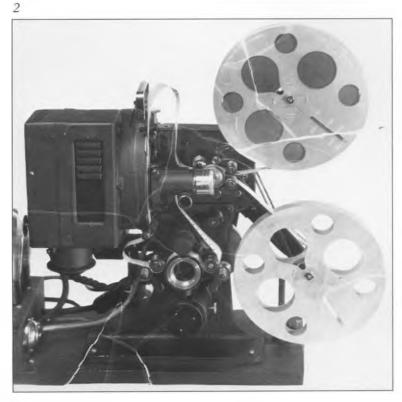


RCA Photophone developed a new high-fidelity sound recording and reproducing system, using the velocity microphone. Other 1932 Photophone achievements were the development of two all AC-operated theatre sound systems and 16-millimeter equipment for home and classroom use. Victor records introduced a disk made from transparent material in 1932. It was laminated, with pictures of recording artists and printed words visible through its surface. In 1933, an improved flexible disk was developed which was less susceptible to breakage.

In the fall of 1933, RCA Victor introduced a new series of radio-phonograph combinations and an all-wave, eight-tube superheterodyne radio. The latter, known as the "Globe Trotter," became a popular set throughout the 1930's. A new personalized velocity microphone, worn in a speaker's button hole or breast pocket, was also developed in 1933.

The company began marketing a new, small record-playing device in 1934 which plugged into a radio to produce sound. To improve outdoor recordings for broadcast, a new "inductor" type microphone was developed at Camden in 1934. The first amateur 16-millimeter sound-on-film motion picture camera and projector was also produced in 1934.











RCA Victor Company, Inc., Camden, N.J.

NUMBER 1

5

OCTOBER, 1931

- 1) The first RCA Photophone 16-mm amateur sound-on-film movie camera, June 1934.
- 2) Early RCA Photophone 16-mm movie projector built in Camden, January 1934.
- 3) This RCA Photophone, containing the type PS-24 sound attachment, was produced in Camden in 1933.
- 4) RCA Victor recording artist Rudy Vallee, striking a pose with the RCA Victor velocity microphone, May 23, 1933. The velocity microphone, invented in 1931, became the broadcasting industry standard.
- 5) In October 1931, RCA Victor published the first issue of Broadcast News, a convenient medium for the exchange of ideas and information in the world of radio broadcasting. This publication grew to become the "Bible" of the US broadcasting industry, read by millions of technical, sales and service personnel from coast-to-coast.
- 6) The RCA Victor "Inductor" type microphones were introduced in 1934. The type 50-A, weighing only three pounds, was a portable model designed for improved pickup of outdoor broadcasts.





1) The RCA Victor Employees Band leading the "Back to Work" parade eastward along Cooper Street, Camden, NJ, 1933. The event was a boost to morale and a celebration of the company's strength in surviving the Great Depression.

RCA and the Great Depression (1929-1934)

The Radio Corporation of America had become well-diversified in products and services by 1929, an important factor in the company's subsequent weathering of the Great Depression. Following the stock market crash in October 1929, the entire radio industry suffered heavy financial losses. RCA's annual sales reflected this fact, plunging from \$182 million in 1929 to \$127 million in 1930; \$102 million in 1931; \$67 million in 1932 and \$62 million in 1933.

Despite the heavy losses, RCA was able to survive and recover. The strong businesses of RCA Communications, Inc., the Radiomarine Corporation of America and the National Broadcasting Company remained profitable throughout the early 1930's, making up for the losses suffered by RCA Photophone, Inc., RKO, the RCA Victor Company, Inc. and the RCA Radiotron Company, Inc. By 1934, the company's annual income had bounced back from \$62 million to \$78 million.

RCA Becomes an Independent Company (1930-1932)

Following the organization of the RCA Victor Company, Inc. and the RCA Radiotron Company, Inc., the US Government began to intervene. It had become concerned about the phenomenal growth of RCA, the same organization it helped form eleven years earlier. An antitrust suit was brought against RCA on May 31, 1930, naming GE, Westinghouse, AT&T and others as co-defendents. The Government's plan was to show that RCA's patent pooling in the early 1920's was a combination in restraint of trade. It wanted RCA to dissolve its pool and return some 4,000 patents to dozens of former owners.

Sarnoff, who was selected as RCA's third President in January 1930, was engulfed in this legal battle for the next two years. The Government settled with AT&T directly. Negotiations were held between RCA, GE and Westinghouse to reach an arrangement that would appease the Government before going to trial. The three agreed that there was more to lose by going to court. An agreement was reached to liquidate nearly \$18 million owed by RCA to GE and Westinghouse-half by cancellation, about \$5 million more through the transfer of the new RCA Building at 570 Lexington Avenue in New York City to GE, the rest by the issuance of debenture bonds to GE and Westinghouse. GE and Westinghouse also agreed to enter into competition with RCA, after refraining from radio manufacturing long enough to enable an independent RCA to become established in the commercial market.

In the fall of 1932, just before the case was

to go to trial, RCA settled with the Government. On November 21, 1932, RCA became a selfcontained company. Having become independent, RCA now had its own laboratories for research and engineering, its own manufacturing facilities, its own broadcasting and entertainment activities and its own marine and trans-oceanic radio communications services. Additionally, RCA retained rights under the patents of those companies with which it had cross-licensing agreements and retained the right to license others under those patents. GE and Westinghouse agreed to distribute their RCA stock only to their own stockholders. The two electrical companies resigned from the RCA Board of Directors and agreed to refrain from competing with RCA for the next two and a half years. GE began development on a new receiver line at the General Engineering Laboratory, Schenectady, NY in 1933 under Ira J. Kaar. Two years later, a receiver manufacturing department was set up by GE at Bridgeport, CT in a plant purchased from Remington Arms after World War I. On May 21, 1935, GE re-entered the radio manufacturing business, this time as a competitor to RCA.

A number of other important legal transactions occurred between 1930 and 1932 which boosted RCA's growth as an independent corporation. It gained full ownership of NBC in 1930. In 1931, E.T. Cunningham Inc. was taken

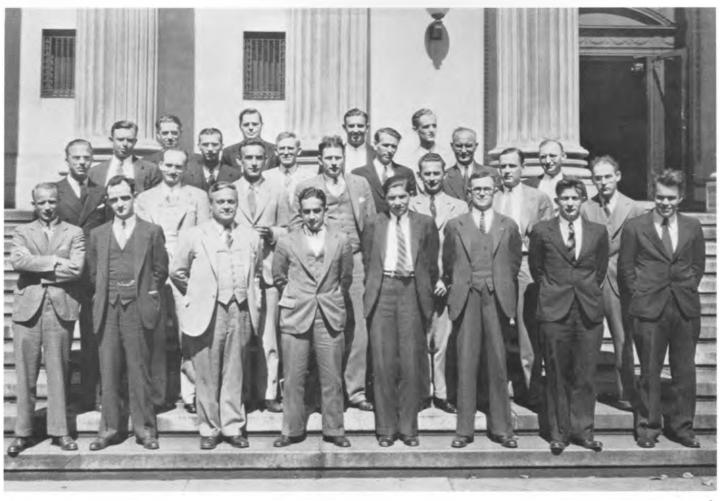
over by RCA and organized under the RCA Radiotron Company, Inc. on January 1, 1932.

Also on January 1, 1932, RCA Photophone, Inc. was taken over by the RCA Victor Company, Inc. About this time, the offices, personnel and operations were transferred from New York City to Buildings #4 and 8 in Camden, NJ.

By the end of 1932, the RCA Victor Company, Inc., headquartered in Camden, NJ, had become a concentrated, powerful center for research, engineering, manufacturing and selling of a multitude of consumer, industrial, commercial and government communications electronics products.

2) A rare 1932 photo of some of the top managers, engineers and salesmen responsible for the success of RCA Victor, Camden, in both commercial broadcasting and defense electronics. Standing before the company's switch engine at Building #24 were (l-r): Irving Wolff, acoustic engineer; Loren F. Jones, development engineer; John P. Taylor, transmitter sales engineer; William Witty, southwestern district manager for transmitter sales; I.R. Baker, manager of the transmitter sales section in Camden; Ben Adler, southern district manager for transmitter sales; Harold C. Vance, central district manager for transmitter sales; Ted A. Smith, eastern district manager for transmitter sales; J.M. Sawyer, assistant manager, Engineering Products Division in Camden; Harry F. Olson, acoustic engineer; E. Jay Quimby, first editor of Broadcast News. Courtesy: Loren F. Jones.







- 1) Members of the Service Division of the RCA Victor Company posed for a group photo on the steps of the Cooper Library, Camden during a September 6-9, 1932 conference. Pictured (l-r) front row: C.W. Butt, J.E. Heney, A.J. Reddy, J. Mauran, M.A. Walsh, H.L. Whitney, H.M. Leighley, J.P. Allen. Second row: O.V. Swisher, J.D. Steely, R.P. May, F.B. Ostman, S.F. Niellsen, J.A. Morris, A. Goodman. Third row: W.H. Bohlke, P.P. Melroy, E.T. Hamilton, E.M. Hartley, W.W. Brewer, C.J. Faulstich. Top row: G. Allen, C.C. Aiken, A.W. Schneider, M.J. Yahr. The Service Division became the RCA Service Company, Inc., a wholly-owned subsidiary of RCA, on December 24, 1942.
- 2) This Ford Model A was one of several delivery and service vehicles used by RCA Victor in 1932.



- 3) This 1920's Pierce-Arrow delivery truck, one of 24 originally acquired by the Victor Talking Machine Company, continued to faithfully serve the RCA Victor Company in 1932.
- 4) RCA Victor Service Division technicians posing with a stockpile of Model M-34 auto radios, June 1933. The first in-dash, factoryinstalled automobile radios in the US were designed and manufactured by RCA in Camden.



RCA and Radio City (1930-1933)

On June 16, 1930, plans for a great entertainment and cultural arts center in the heart of New York were announced by Todd, Robertson and Todd, representing the John D. Rockefeller, Jr. interests and David Sarnoff, President of RCA. The \$250 million project, financed by Rockefeller, would encompass three blocks square: from 48th to 51st Streets, between Fifth and Sixth Avenues. RCA and its subsidiaries in the entertainment field were to become the chief occupants of this new center. The heart of the complex, to be called "Radio City," was the 60-story "RCA Building." This was to become the new headquarters offices for RCA, as well as the largest and most modern studios in the world for NBC, two RKO theatres, and RKO offices.

Radio City was completed, as planned, by 1933. RCA moved its headquarters offices to the 52nd and 53rd floors of the RCA Building on June 2. Guglielmo Marconi, visiting the United States as the guest of RCA from September through November 1933, was honored at a rooftop ceremony by David Sarnoff and Merlin Aylesworth, President of NBC. The NBC offices were moved to the RCA Building November 3-5. The state-of-the-art studios for NBC were dedicated on





- 1) The 60-story RCA Building, completed in 1933, became the new home for RCA corporate headquarters and NBC. The building was the centerpiece of "Radio City," a \$250 million project funded by John D. Rockefeller.
- 2) The eighth-floor NBC broadcasting studio (8H) at Radio City, New York, was the world's largest upon its completion in 1933. (It seated over 1,100 persons.) The recording, broadcasting and sound systems were designed, built and installed by RCA.

November 11, with an elaborate program broadcast from coast to coast and to several foreign countries. A highlight of the historic broadcast was a two-way conversation between Sarnoff in London and General James Harbord, Chairman of the Board of RCA, Owen D. Young, Chairman of the Board of the General Electric Company and Sir John Reith, Director-General of the British Broadcasting Corporation, sitting before the NBC studio audience in New York. This was the first in a series of dedicatory programs broadcast throughout the following week.

Another major architectural wonder of the Rockefeller complex was Radio City Music Hall. With a seating capacity of 6,200, the Hall entertains over 80 million people a year. RCA engineers helped design the auditorium for optimum acoustics. The sound systems were designed and built at RCA Camden.





- 3) The main console at NBC Studios in the RCA Building was designed, built and installed by the RCA Victor Company, Inc., Camden, NJ.
- 4) Posing for the press on the roof of RCA's new headquarters at 30 Rockefeller Plaza, New York City were (l-r): Merlin H. Aylesworth, president of NBC; Guglielmo Marconi and David Sarnoff, president of RCA. As the guest of RCA, from September 28 to November 2, 1933, Marconi toured Radio City and many other RCA facilities.

Other RCA Highlights (1930-1934)

The early 1930's was also a period of significant developments by RCA Communications, Radiomarine, RCA Radiotron and NBC. Some highlights are worthy of mention.

RCA Communications, Inc. established the first direct radio telegraph communications with China on December 6, 1930, when it opened the San Francisco-Shanghai circuit. Other circuits opened in 1930 were: Chile (Santiago), January 13; Philippines-Macao, March 20; Panama, May 1; San Francisco-Panama, May 10; Philippines-Spain, October 27; Moscow, November 13; Czechoslovakia (Prague), December 1; and Santo Domingo, December 24.

The voice of the Pope was heard worldwide for the first time on February 12, 1931, when Pope Pius XI inaugurated the Vatican radio station. Direct signals from the station (a gift to the Pope by Guglielmo Marconi) were picked up by RCA Radio Central at the Riverhead, LI, NY receiving station and broadcast throughout the United States via the NBC network.

RCA Communications, Inc. and the Western Union Telegraph Company made an agreement on September 23, 1931 which gave RCA the use of Western Union's stations for domestic collection and distribution of traffic. The RCA frequency checking laboratory at Riverhead, LI, was first offered as a commercial service to US broadcast stations on October 1, 1931.

Three new direct radio telegraph circuits were opened by RCA Communications in 1932: New York-Mexico, March 15; New York-Berne, May 11 and New York-Haiti, July 1. Radio facsimile service, which began in 1926 between New York and London, was extended in 1932 to include the circuits of New York-Berlin (April 18) and New York-Buenos Aires (August 8). RCA's frequency checking service to the public was extended to the west coast with the construction of a laboratory at Point Reyes, CA on August 31, 1932.

The first program from the USSR broadcast in the US was received by RCA Communications and broadcast by NBC on October 21, 1933. The first program from India was broadcast on December 12, 1933. By the end of 1933, RCA Communications handled a total of 209 foreign radio programs for American broadcasting companies.

In April 1934, RCA Communications

inaugurated inter-city radio telegraph service in the US, with rates for a 15-word wireless message similar to a 10-word message by competing wire services. That same year, RCA Communications introduced multiplex radio transmission, by which two separate communication channels were operated on a single wavelength between New York and London. In 1934, RCA Communications handled 715 trans-oceanic programs of foreign origin for broadcast in the United States.

The Radiomarine Corporation of America was responsible for many RCA milestones from 1930 to 1934. The first demonstrations of radio facsimile transmissions to ships at sea were conducted in 1930. Bulletins were sent to the SS America, approximately 3,000 miles from New York. Radiomarine introduced an advanced ship-based transmitter for both long and short wave radio in 1931. A main supplier of radio direction finders, Radiomarine had equipped over 700 vessels by 1932. The first successful demonstration of radio teletype service to ships at sea was another Radiomarine milestone in 1932. On January 6, 1933, shore-

1) Guglielmo Marconi (right) and David Sarnoff at RCA's eastern central transmitting station, Rocky Point, Long Island, NY, October 1933. Marconi, inventor of radio, visited America as a guest of RCA (September 28 to November 2). Courtesy: David Sarnoff Research Center.



to-ship telegraph service was established on several New York piers, allowing persons waiting on the docks to exchange messages with persons on the incoming ships. Finally, in 1934, a joint effort between Radiomarine and RCA Communications resulted in the first remotely-controlled international circuit from a ship.

Significant NBC achievements continued throughout the 1930-1934 period. The first glass curtain, shutting off audience noises from the broadcasting studio stage, was put into use at the opening of NBC's Times Square studio on March 16, 1930.

A six-foot parabolic reflector microphone, larger than any used before, was introduced by NBC at the Democratic National Convention in Chicago on June 27, 1932. It provided the first clear broadcast of the sounds of large gatherings. By the close of 1932, NBC networks had devoted over 165 hours to broadcasting national political conventions. More than 400 high-level government officials were heard on NBC radio that year. On December 18, 1932, NBC announced the development of an experimental echo chamber for broadcasting. The chamber enabled NBC to provide the illusion of a speaker being in environments ranging from a closet to an auditorium.

A new backpack transmitter, measuring only twelve inches square and seven inches deep, was first used by NBC reporters at President Franklin D. Roosevelt's inauguration on March 4, 1933. Improved mobile short wave transmitters, mounted on trucks, were also introduced by NBC in 1933. These transmitters were also introduced for aircraft broadcasts by NBC that year.

One of the most important developments in 1933 was the major use of radio by the President. In his first nine months in office, President Roosevelt was heard on the NBC networks 20 times. Called the "Radio President," Roosevelt had an excellent voice for broadcasting. The first of his historic "fireside chats" was broadcast on March 12, 1933. He delivered three more by the end of the year. The phenomenal growth of NBC was evidenced by its 1934 broadcasts of 45,240 network programs, including 300 from 30 different foreign countries.

The RCA Radiotron Company, based in Harrison, NJ, was also making great strides during the early 1930's. Formed in 1930, RCA Radiotron designed and manufactured tubes for radio receivers. A major achievement was the development of the pentode and super-control

tubes in 1931, which allowed greatly improved broadcast reception. A year later, the first "dome bulb" radio tubes were introduced. In June 1933, the first "acorn" type Radiotrons, measuring 5/8 inches in diameter, were developed. These tubes were instrumental in the study of UHF for commercial use.

Formation of the RCA Manufacturing Company, Inc. (1934)

To further coordinate its manufacturing activities, RCA organized the RCA Manufacturing Company, Inc. on December 15, 1934. This new RCA subsidiary, organized as a Delaware corporation, was created by combining the RCA Victor Company, Inc. of Camden, NJ and the RCA Radiotron Company, Inc. of Harrison, NJ into a single organization. Headquarters for the RCA Manufacturing Company was established in Camden. The new organization also included the RCA Indianapolis plant, which was acquired from Westinghouse in 1932. G.K. Throckmorton was named Vice-President and E.T. Cunningham became President.

- 2) Letterhead for the newly-organized RCA Manufacturing Company, Camden, NJ.
- 3) Radio tube manufacturing at RCA Radiotron Company, Harrison, NJ, July 1934. Formerly the Edison Lamp Works, this facility was jointly owned by GE and RCA until 1932, when RCA gained full ownership. At the time, it was the world's largest radio tube manufacturing plant. It became part of the RCA Manufacturing Company, Inc. on December 15, 1934.

2





A RADIO CORPORATION OF AMERICA SUBSIDIARY

Camden, New Jersey

February 14, 1936.





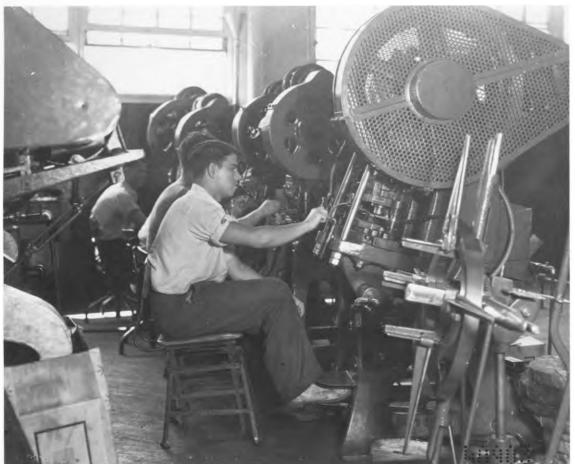
RCA Camden: A Manufacturing City (1934-1939)

By 1934, the RCA Manufacturing Company, Inc., Camden, NJ had become the most complete radio organization and plant in the world. The radio product line included standard and all-wave receivers for automobiles, farms, aircraft, police vehicles, ships and trans-oceanic coastal stations. Broadcast equipment included microphones, transmitters, receivers, consoles, antennas, loudspeakers and test equipment. Centralized radio systems were custom built, many for school use. Motion picture projectors for both theatre and home use were produced, as were home movie cameras. Radio-phonographs and Victor records rolled off the assembly lines daily.

The Camden plant covered an area of nearly three and a half million square feet. In 1935, activities were located as follows: Building #1—Shipping; #2—Administration; #3—component parts, warehouse, incoming stock, hospital and a lunch club; #4 and #8—Photophone apparatus, transmitters and Navy programs; #5, #6, #7—research and engineering;



- 1) Roughing out a wax matrix, on which a Victor recording was later made, March 1935.
- 2) Small parts punch presses, used for manufacturing switches and capacitor plates, August 1935.
- 3) Radio receiver chassis assembly in Building #10, June 1934.
- 4) Automobile radio assembly in Building #10, October 1938.
- 5) Preparing voice coils for radio loudspeakers in Building #13, June 1934.



#10 and #13—record pressing, receiver and loudspeaker manufacturing; #11—dry kilns; #9 and #12—power plant; #15—administration and offices; #17—cabinet factory and hospital; #24—final test and shipping; #53 and #56—antenna assembly, warehouse and garage.

More than 10,000 men and women were employed here at the height of production. Radio receivers were produced at the rate of three to five thousand a day.

Six miles of conveyor systems in the various factory buildings carried the parts used in progressive stages of manufacture. Every month, 2,400 tons of coal and coke were consumed to produce light and heat. More than 1,500 tons of refuse sawdust from the cabinet factory was also used as fuel each month. The coal storage facilities on the wharf had a 40,000 ton capacity. Each day, ships on the Delaware River docked at the plant and were loaded with shipments for foreign markets.

Over 90 million pounds of needed steam was generated monthly, requiring the use of 45 million gallons of water. Another nine million gallons for general use and six million gallons for drinking were also consumed on a monthly basis. The 22 dry kilns at the plant had a combined annual capacity of 17.5 million feet of lumber.

The RCA plant was truly a manufacturing "city" within the City of Camden by the late 1930's.







Product Developments (1935-1939)

During the second half of the 1930's, RCA Camden had become involved in a wide variety of communications products. Automobile radio manufacturing was at its height, with sets being sold to both Buick and Sears Roebuck and Company. The Sears model was mounted beneath the dashboard; the Buick model fit into the instrument panel.

RCA Camden grew strongly in airborne communications during this period. In 1936, RCA Aviation Radio Headquarters was established at Central Airport (northeast of present-day Airport Circle), Camden. Testing of government and commercial aircraft transmitters, radars and location equipment was carried out in a company-owned Ford tri-motor monoplane.

Mobile communications equipment was designed, built and installed in police vehicles. The first models were powered by a generator driven by the fan belt. Later models were powered by the car's battery. The company also manufactured transmitter consoles for police station dispatchers.

Beginning in 1935, two amateur radio receivers were produced and sold. The RCA Victor School Sound System was also introduced in 1935. A centralized cabinet console, containing a radio, phonograph, and velocity microphone, fed up to 40 rooms with news and music. RCA Victor Photophone projectors had also become popular in schools by this time.

The first all-metal radio receiving tubes were invented in 1935 and the RCA Manufacturing Company began offering them in certain home receiver products.

RCA Photophone concentrated its efforts on sound motion picture recording for studio use and on television projection equipment and sound systems for theatres. The Photophone business expanded to include operations at Indianapolis, IN and Hollywood, CA. The Indianapolis plant, acquired from Westinghouse in 1932, was upgraded in 1936 to manufacture speakers, microphones, sound heads and recorders. A new and highly-efficient method of sound motion picture recording, using ultra-violet instead of visible light, was introduced in 1936.

Broadcast systems produced by RCA Camden were unrivaled in the industry. RCA was the leading supplier of professional broadcast equipment in the United States. Stations from coast to coast were outfitted with microphones, high-powered transmitters, broadcast antennas, control consoles, sound recording and sound reproduction equipment—all designed, produced, installed and maintained by RCA Camden personnel. The first mobile television pick-up units, housed in trucks, were designed and built in Camden for use by NBC, beginning in 1937.

RCA Victor also succeeded in applying radio principles to diverse fields in 1935 with the development of two innovative devices. One was the "Chronograph," a watch-analyzing mechanism which checked timepieces and automatically printed the status of their individual parts. The other unique development was a weapon detector system for prisons, which automatically set off an alarm when inmates attempted to smuggle in metal weapons.

Facsimile receivers for recording radiobroadcast newspapers and other graphic material in the home were built at RCA Camden and demonstrated in February 1938 to the National Association of Broadcasters in Washington, DC.

A kidnap/burglar alarm, containing a capacity- operated relay to sense motion, was introduced in 1936. Backpack transmitters with inductor microphones were being produced for NBC and other news reporting agencies. Customized communications systems were built for the Pennsylvania Railroad, allowing the locomotive engineer to talk to his crew in the caboose a half mile behind the freight cars. Radio product advances continued in 1938 with the development of the RCA Camden "pick-me-up" portable battery set. In 1939, RCA Victor introduced an automobile radio with a push-button tuning feature.

In 1939, in cooperation with the Story and Clark Piano Company, RCA Victor produced an electronic piano, in which tones were produced by tubes and loud speakers instead of by strings.

A final highlight of this period was the development of the first electron microscope at RCA Camden. The first developmental model, with magnifying power 20 to 25 times greater than existing light microscopes, was demonstrated in 1938. The first practical model was unveiled in 1940.

- 1) Early RCA Camden in-dash automobile radio (center, with four knobs and circular tuning dial), December 1936.
- 2) The in-dash automobile radio, produced by RCA Camden for Buick, was the first factoryinstalled model offered in America. Production began in Building #10 in the late 1930's.
- 3) The RCA Victor model #8M automobile radio, a five-tube superheterodyne, was the sensation of the 1938 line. The unit was mounted beneath the dashboard and was easily removable for transfer from one car to another.
- 4) The first pushbutton automobile radio, developed by RCA Camden engineers in 1938, was offered to the industry in 1939.







THE SENSATION OF THE YEAR

RCA Victor 8



Better Performance!

 A five-lube Superheterodyne with non-synchronous vibrator. Tuning range 550-1500 kcs. Tube complement: 1 RCA 6A8G, 1 RCA 6K7G, 1 RCA 6Q7G, 1 RCA 6K6G, 1 RCA 6X5G. OTHER FEATURES: A single unit complete with controls and speaker. No holes to drill in face of instrument panel. May be easily transferred from one car to another without leaving unsightly holes. Universal for all cars—independent of instrument panel design. Surprising volume and tone. Magnetite Core Antenna Transformer greatly improves sensitivity. Magnetite Tuned I-FT ransformers permanently "lock" factory-tuned circuits in perfect alignment. Big, easy-reading illuminated dial.









- 1) Aerial view, looking southeast, of Central Airport (above the traffic circle) in Pennsauken Township, NJ, 1931. RCA Aviation Radio Headquarters was established here in 1936 for testing aircraft transmitters, receivers and radar altimeters.
- 2) The RCA model AVT-15 aircraft transmitter was introduced in 1938.
- 3) Four aircraft owned by RCA parked alongside the hangar which served as "Aviation Radio Headquarters," Central Airport, December 1936. The Ford tri-motor monoplane (far right) was used for pioneering tests of tele-vision relay equipment.
- 4) Diagram of an RCA aircraft communications system mounted in a small plane, March 1939.









- 1) The Camden Police Department was one of RCA's first customers for mobile communications equipment.
- 2) Police dispatcher with a broadcast transmitter built by RCA Victor, December 1936.
- 3) RCA microphones were installed in police cars for two-way communications by 1936.
- 4) The Chicago Park District Police purchased RCA mobile communications equipment in 1938. Note the vehicularmounted antennas on the roof and trunk.





- 1) RCA Victor centralized radio systems combined music by radio and phonograph, as well as a public address system, in a single compact control console. This model was introduced in 1938.
- 2) Members of the Camden Fire Department testing a public address system built and installed at RCA Camden, October 1937.
- 3) The RCA Victor Photophone Division expanded in October 1936 with the transfer of the production division to the company's plant in Indianapolis, IN. Headed by C.N. Reifsteck, the operation produced soundheads, amplifiers and various component parts at a high rate of efficiency.
- 4) RCA Victor Photophone, 1935.
- 5) RCA Victor technician servicing a theatreinstalled Photophone, September 1938.
- 6) Plaques such as this, mounted in theatre lobbies across America, promoted RCA Photophone sound systems in the late 1930's.









- 1) RCA Victor introduced school sound systems in 1935.
- 2) The RCA Victor AR-60 communications receiver, introduced in November 1935, was one of the first amateur models.
- 3) Custom communications systems were built for the Pennsylvania Railroad in 1938, allowing the engineer to talk to the crew in the caboose. Note the dipole antennas mounted on the roof.

Complete RCA VICTOR School Sound System

This beautiful walnut cabinet contains the controls for the complete School Sound System. From such a central cabinet, programs or announcements may be distributed to as renewed. When not in use the Cabinet may be locked. Overall dimensions are Width 42: Height 73%: Depth 1819:

RADIO SECTION

The radio section, located in the upper part of the cabinet, includes I Two RCA Victor All-Wave Radios. Two Airplane Dials for easy tuning. Two Monitor Loudspeakers—not for each Sound Channel, Volume. Tone. Waveband, Station Selector—Controls. Both radios are the finest and latest all-wave RCA Victor models, famous for their fieldity of tone.

SWITCH CONTROLS

The typical switch panel control shown is flexible enough to meet all practical operating conditions. Each switch controls the distribution of sound to its owncleasroom in classrooms from four control positions:

"A" for one Sound Program. "B" for the Second Sound Program. "S" for Supersisory Control. Off "in this notifion all sound is not off severe impatter control.

ANNOUNCEMENT AND PHONOGRAPH SECTION Contains 16 Automatic or Magnally Operated 2 Speed

. dd High Gain Ampillisen. 'e Provision for Geforn Magnetic. or Velocity Migfophone.

'The master weith efables you to turn all all the classrooms simultaneously, but leaves he Monitor loudspeakers free. The makes it easy to furne in on the Monitor before switching a program into any classroom. When the principal links apealing through thy

TO SUIT YOUR REQUIREMENT

The cost of an RCA Victor School Sound System depends on the size of the school and the number of sound units desired. Whether you are considering a compilet or a partial system, you may be assued that RCA Victor sound squipment gives outstandingly superior results.



VELOCITY MICROPHONE

The farous RCA Victor Velectry Microphone is used by the great thaters of Radio City, Rocksfeller Center, and by NBC, CBS and other breadcesting stations where only the fines sound separated is installed. Its prime advantages are superhim activations and fidelity of time combined with sensitive size and fidelity of time combined with sensitive size of the combined size of the combined

ιΓI

LOUDSPEAKERS

RCA Victor Loudepeakers deigned for table or wall mountng are included in the classroomasyminasium and other indoor locations. They are noted for their high efficiency and line natural

In the Auditorium, RCA Victor Directional Baffle Loudspeakers are installed. These loudspeakers, because of their directional characteristics help to overcome acoustical difficulties or "dead apota" so that pupils

OUTDOOR LOUDSPEAKERS

Weather-proof metal Directional Loudspeakers has been designed primaril for use at sutdoor athletic sents - football haseball, thick, or out-

stickents football, whall there are football there are used to rest and perfect railing. They insure trouble-tree service and perfect of coverage. The speaker can be tilted at any angle also rotated a any degree desire. The trade of any degree desire.

sphaker can simply be "plugged into" the School Sound Syntim whenever needed When used as a permanent flatter it is incorporated in the School Sound System, with apermanent housing. RCA Letter All-Weather Loudspeakers are in use whereers mality rousedness and reliability are demanded.

NOTE: Where combin technical are required in decidination with the School Syane System, such and Sound Medium Fistures in specially designed Seame System is provided, with a Book and Panist Set Size Central Sound Control (Set), lessed at the Colleges showing 5 this page.









4) RCA Camdeninstalled dipole antennas, mounted on the coal car, allowed locomotive engineers to communicate with the crew a half mile behind the freight cars. Installations were performed at the Pennsylvania Railroad station, adjacent to the Camden plant.







- 5) Backpack transmitter with inductor microphone, built by RCA Victor for NBC and other "roving reporters," July 1938.
- 6) The TT-1A television broadcast transmitter, built at RCA Camden in 1938, was the first offered for sale, beginning in 1939.
- 7) Broadcast transmitter and control console built for NBC-owned station WRCA, August 1938. RCA Camden was the recognized leader in commercial broadcast equipment throughout the industry by the late 1930's.

1) The RCA Victor "Magic Eye" and "Magic Brain" mobile advertising vehicles toured America, beginning in 1935.

2) The RCA Victor sales convention for distributors, held in Atlantic City, NJ in July 1935, included many members of the RCA family. Among them were (fourth from left): E.T. Cunningham, president of RCA Victor and (second from right): G.K. Throckmorton, executive vice-president, RCA Victor.

Advertising and Sales Promotions (1935-1939)

RCA Victor advertising in the 1930's was quite extensive, conducted through a variety of innovative media.

The company created catchy campaigns to market its new commercial receiver lines. Terms like "Magic Brain" and "Magic Eve" were used to describe uniquely-designed tuning controls and displays incorporated into the new models. To promote these products, the company built three sound trucks which traveled the country as mobile demonstration units. During 1935, these trucks covered over 50,000 miles, visiting dealers and distributors in nearly every state. They also participated in many special events, including conventions and parades. One important event was RCA Victor's mid-summer sales convention, held in the resort town of Atlantic City, NJ. Hundreds of dealers and distributors flocked to the two-day convention to witness the unveiling of new RCA Victor radio products. The campaign was very effective. The Company

simultaneously held advance showings of its new product lines to dealers and distributors in key cities throughout the country. Orders poured in and the Camden plant went to full production.

Following the reorganization of the RCA Victor and RCA Radiotron Companies into the RCA Manufacturing Company, two new showrooms were established. One was located in Chicago and the other was in the Building #2 lobby at RCA Camden. These showrooms carried a complete display of products, ranging from the latest radios to Photophone theatre equipment. Dealers and distributors were invited to Camden for tours that included both the factory and showroom. This type of advertising was very effective, resulting in increased orders and sales of RCA Victor products.

A new nation-wide campaign commenced in 1937, highlighted by the slogan "RCA ALL THE WAY." As an incentive to dealers, contests were set up and cash prizes were awarded to top performers.







3

3) Entrance to the magnificent display room of RCA Victor products on the first floor of Building #2, Camden, NJ, May 1936.





A FREE TRIP to the RCA VICTOR PLANT AT CAMDEN, N. J. (all expenses paid)!



FOR RCA VICTOR DEALERS EXCLUSIVELY!

NATIONAL PRIZES

1st Prize: \$250.00 in cash (plus \$25.00 District 1st Prize) and a Free Trip to the RCA Victor Plant at Camden, N. J. (all expenses paid)

2nd Prize \$100.00 in Cash
3rd Prize \$50 in Cash

DISTRICT PRIZES

For the purpose of this contest, the United States has been divided into 19 districts as shown in the map below. The same set of prizes will be awarded in each of the 19 districts. In competing for these prizes you are not competing with dealers all over the country, but only with dealers in your district.

DISTRICT PRIZES ARE AS FOLLOWS:

1st Prize (in each District) . . . \$25.00 Cash 3rd Prize (
2nd Prize (in each District) . . . \$15.00 Cash Six addition

3rd Prize (in each District) \$10.00 Cash Six additional prizes in each district \$5.00 Cash

EVERYONE HAS AN EQUAL CHANCE TO WIN-IT'S A FAIR, SQUARE CONTEST I



6



3

EVERYBODY'S GOING RCA ALL THE WAY

- 4) A 1936 ad for the RCA Victor kidnap/burglar alarm. Courtesy: Ron McHugh, GE GCSD.
- 5) A 1937 ad for RCA Victor microphones and radios. Courtesy: Ron McHugh, GE GCSD.
- 6) Contest announcement to RCA Victor dealers in 1937. Courtesy: Ron McHugh, GE GCSD.
- 7) New mascot introduced for the 1937 "RCA ALL THE WAY" advertising campaign.

Promotional literature on RCA Victor product developments and other milestone achievements was produced in great quantities in the late 1930's. New publications began both at corporate and company levels. The first publication dedicated to the RCA "family" of employees began in March 1935. Known as Within the RCA Family Circle, this monthly newspaper was the first of many publications to focus on both the professional and personal lives of employees.

Many new publications, aimed at customers, dealers, distributors and employees rolled of the Camden presses from 1936 to 1939. Articles in *The Scanner, Photophone News, Victor News, Listen, RCA Radio Service News* and *RCA Victor Spotlighter* kept the world informed on the latest developments at "Radio Headquarters" in Camden, NJ.

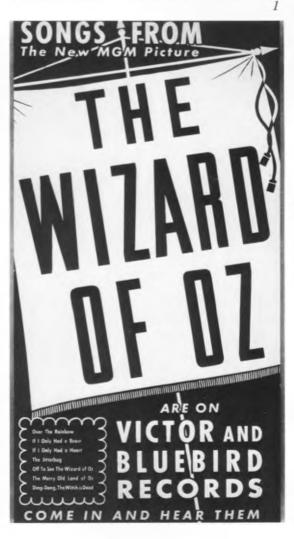
In keeping with the sucessful campaign established by its predecessor, the Victor Talking Machine Company, RCA Camden continued the widespread use of Nipper and "His Master's Voice" in both domestic and international advertising. The world's most famous dog continued to grow in popularity by his association with RCA radios, radio-phonographs and Victor records throughout the decade.



and his orchestra

VICTOR RECORDS





- 1) One of many promotional publications introduced by RCA Victor in the late 1930's, Photophone News kept customers, dealers and distributors informed on the latest developments in sound motion picture recording and reproduction equipment. Photophone News was first published in July 1937.
- 2) With the advent of the "Big Band" era, artists such as Benny Goodman and Glenn Miller received heavy publicity through RCA Victor records advertising. This ad appeared in early 1939.
- 3) Concurrent with the 1939 release of the MGM smash hit The Wizard of Oz, RCA Victor launched a nation-wide campaign to advertise the motion picture soundtrack. Bluebird records, introduced in 1933, augmented the existing Red Seal and Black Label record product lines.

RCA Government Communications (1931-1939)

As early as 1931, RCA Camden was engaged in research, development and production of communications equipment for the US Government. Products ranged from test devices to facsimiles; from transmitters to receivers and from Photophone projectors to Victor records. The Navy Department was one of RCA Victor's main government customers, purchasing a variety of communications gear ranging from frequency test meters to high-powered transmitters and facsimiles. The US Army Signal Corps also began purchasing communications products for both ground-based and airborne applications from RCA Camden in the early 1930's. Both the Army and Navy took an avid interest in RCA's pioneering efforts in microwave communications and television equipments. Cooperative efforts with both services led to major breakthroughs in radar and sonar during the 1930's.









- 1) Special test equipment, like this heterodyne frequency meter, were being produced by RCA Camden for the US Navy as early as 1932.
- This facsimile system was produced in January 1934 for the US Navy by the Engineering Products Division of the RCA Victor Company, Camden, NJ.
- 3) This RCA Victor public address system (Note four speakers on roof), sold to the US Army Signal Corps in 1934, was used for all ceremonies at the Memorial Amphitheatre, Arlington National Cemetery, Arlington, VA.

Radar Pioneering at RCA Camden (1932-1939)

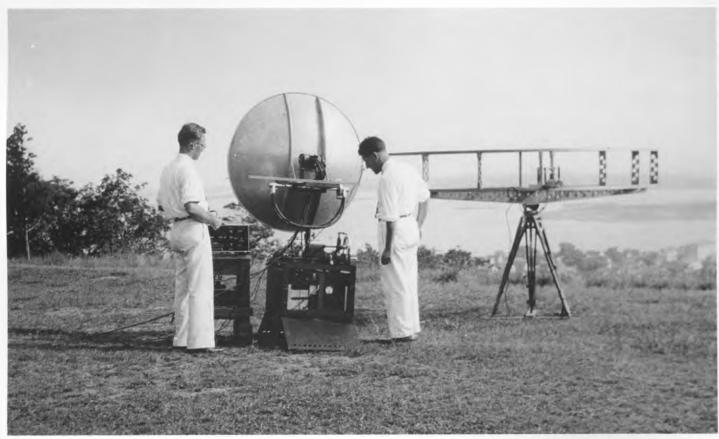
Basic research in microwave communications was instituted by the General Research Lab of RCA Camden as early as 1932. In August 1934, in cooperation with the US Army Signal Corps at Fort Monmouth, NJ, Camden engineers conducted pioneering tests with microwave equipment. From a hilltop on the coastal town of Atlantic Highlands, NJ, ships were detected by listening to the tone of the reflected wave through the receiving equipment. These tests, carried out under great secrecy, proved that even with experimental devices, ships could be detected with microwaves.

These equipments, however, had limited use in determining distance of the reflecting object. Work began immediately in the Building #5 lab by Dr. Irving Wolff, Dr. Ernest Linder and others to develop equipment utilizing waves transmitted in trains of short pulses rather than continuous waves. By spring 1935, rooftop tests at Building #5 were being conducted to determine distance, as well as direction of ships on the Delaware River and objects on the Philadelphia skyline. Using scanning antennas, reflected images were received and displayed on a cathode-ray tube.

In 1937, the first microwave scanning radar capable of displaying accurate distance and location of detected objects was demonstrated in Camden to a team of Army and Navy personnel. That same year, RCA Camden delivered the first airborne equipment to the Army Signal Corps. Tests were conducted on a company-owned aircraft at Central Airport, Camden, using two pulse-type radars. One pointed down and the other ahead, acting as a radar altimeter to measure distances to other planes, mountains and the ground below.

The first experimental ship-based radar for the US Navy was installed by RCA on the USS Texas in 1938. The Naval Research Laboratory (NRL) installed similar equipment on the USS New York. After observing these equipments on successful sea trials, the Navy decided to purchase additional sets. Recognizing RCA as the pioneer in microwave radar, the Navy awarded a contract for six sets to Camden in October 1939. These sets, for aircraft detection, were based on NRL's design. RCA had received the first US Navy radar equipment order. The sets were installed on Navy vessels beginning in 1940. RCA radar equipment was the only radar equipment in use by the Navy when the US entered World War II.

1) Dr. Ernest Linder (left) and Dr. Irving Wolff, testing a newlydeveloped microwave transmitter (dish on left) for the US Army Signal Corps Laboratories at Atlantic Highlands, NJ in August 1934. These pioneering tests proved that ships entering New York harbor could be detected by means of microwaves. This work by Drs. Linder and Wolff, under the RCA Victor Company's General Research Labs in Camden, led to the development of radar. Photo courtesy: Dr. Ernest Linder.









- 2) Dr. Irving Wolff, adjusting a microwave receiver on the roof of Building #5, Camden, NJ, in preparation for tests over the Delaware River to Philadelphia, spring 1935.
- 3) Dr. Ernest Linder, operating a microwave transmitter on the roof of Building #5, spring 1935. The receiver was located in the tower of Camden City Hall (visible in the background). Photos courtesy: Dr. Ernest Linder.
- 4) "Doc" Wolff working on radio altimeters, which he invented at the RCA Camden laboratories in 1937.

Sonar Pioneering at RCA Camden (1934-1939)

As early as 1934, the RCA Camden scientists and engineers began development of underwater sound detection and ranging equipment for the US Navy. Experiments were conducted in the Delaware River, two blocks from the Building #5 lab. These tests led to the development of a compact, lightweight underwater detection device for use by Navy divers and swimmers. The device was so sensitive that it could detect a 10-inch long, quarter-inch thick steel rod from 50 feet away. The Navy, recognizing RCA as a sonar pioneer, subsequently awarded the company 54 contracts during World War II.

Television Developments (1930-1938)

With the consolidation of research and manufacturing for RCA, GE and Westinghouse at Camden in 1929-30, the pace of television development accelerated. The early 1930's saw steady progress by both the RCA Victor Company and NBC in television experiments.

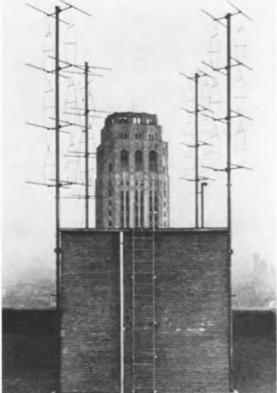
On January 16, 1930, RCA showed the first pictures on a six-foot screen at RKO-Proctor's 58th Street Theatre in New York. The 60-line images were transmitted from RCA's experimental station W2XBS at 411 Fifth Avenue.

In June 1931, the Empire State Building was selected as the new site for the RCA-NBC television transmitter. The Empire State Building was the world's tallest skyscraper at 102 stories. The studio and transmitter equipment were located in the Empire State Building, with the antenna mounted at the very top. Experimental field tests began in October 1931. On November 16, field tests for television between New York City and Harrison, NJ were initiated, using 120-line progressive scanning. Station W2XBS began regular television and radio facsimile operations on December 22. The New York area tests continued through 1932.

Other RCA milestones in 1932 included







- 1) Loren Jones, development engineer for RCA's General Research Labs in Camden, NJ, measuring the radiation pattern of the Empire State Building antenna from a dirigible in 1935. In order to obtain the vertical measurements, the dirigible floated down from 4,000 feet to only 30 feet above the East River. Unsuspecting New Yorkers, thinking the dirigible was crashing, quickly organized a rescue effort. Courtesy: Loren Jones.
- 2) The first microwave relay in the United States, being tested by RCA Camden engineers at Arney's Mount, NJ in 1936. These initial tests were conducted with experimental television receivers temporarily set up in the woods. A permanent relay station was set up shortly thereafter. This pioneering achievement enabled the first television programs to reach Camden and Philadelphia from New York City, 90 miles away.
- The RCA transmitting antenna in New York City, used for the automatic relay circuit between New York City and Philadelphia, July 1936.

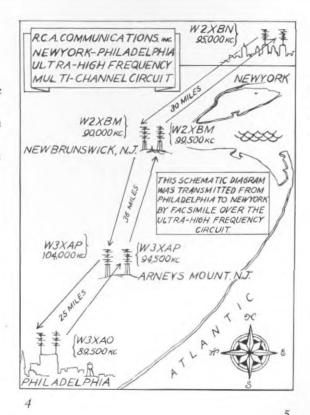
the first television demonstrations for RCA officials and sales engineers (January 11), the first NBC experimental broadcasts from W2XBS with live talent (February 6) and the first television demonstration for members of the Federal Communications Commission (May 7).

The next experimental tests were initiated in 1933. This time, an entire system was built at RCA Camden. Two transmitters were located in Building #2, with the antennas mounted on masts on the roof. The studio and control equipment were located in Building #5, 1,000 feet direct-distance away. A remote pick-up, using the Iconoscope for improved picture definition, was located one mile east. Picture definition was increased from 120 to 240 lines. An outdoor program was televised, relayed one mile to the studio and re-transmitted to a television receiver four miles east in Collingswood, NJ.

A paper giving a preliminary outline of work in the RCA Camden laboratories with the Iconoscope television camera was presented to the Institute of Radio Engineers (IRE) in Chicago, June 6, 1933.

Field tests continued, using the Iconoscope for scanning. Ultra-high frequency (UHF) signals from New York were relayed through Arney's Mount, NJ and successfully received at Camden, 90 miles away. The picture definition was 120 lines. The New York-Arney's Mount-Camden automatic relay, the first in the United States, successfully transmitted experimental television programs in 1933.

In 1934, the RCA Camden laboratories began a new series of television field tests, using 343 lines and 30 frames a second. In a statement made to RCA stockholders on May 7, 1935, President David Sarnoff presented a three-point plan for RCA success in television. The plan included: 1) establishing the first modern television transmitting station in the United States; 2) manufacturing a limited number of television receiving sets for testing; and 3) developing an experimental program service. Sarnoff estimated the project cost to be approximately \$1 million. Sarnoff's announcement made front-page headlines in newspapers across the country and attracted worldwide attention. The press praised the authoritative move taken by RCA to provide the first comprehensive test of television under practical conditions in the United States. The statement clearly outlined the progress in television research through 1935, as well as those problems remaining and the steps RCA was taking to resolve them.



4) Pictorial diagram of the New York-Philadelphia ultrahigh frequency (UHF) relay system, 1936.



5) Early television studio camera, using the Iconoscope developed by Dr. V.K. Zworykin, at RCA Camden, July 1936.

The project commenced that year. In June 1936, about 100 experimental receivers, employing the Kinescope picture tube, were built and placed in the homes of RCA executives and engineers for observation of the transmissions.

Other important developments in 1935 were the "electron image tube" and "electron multiplier tube", which were to become important contributions to the fields of physical and biological research. The electron multiplier tube, capable of electric amplification on the order of hundreds of thousands of times within a single tube, was developed and demonstrated.

RCA opened the first microwave (UHF) automatic relay circuit in the United States between New York and Philadelphia in 1936. Television research progressed and picture

definition was increased from 343 to 441 lines. This was demonstrated for the first time on a 15 x 20-foot screen at the New Yorker Theatre in 1936. During field tests, started on June 29, 1936, transmissions from atop the Empire State Building were being clearly received at distances up to 45 miles.

The first demonstration of an outdoor television pickup was made at RCA Camden on April 24, 1936. Using local firemen as actors, the broadcast was on a six-meter wave over a one-mile distance.

These elaborate field tests continued until 1939 at a cost of over \$2 million to RCA.

On May 12, 1937, RCA announced the development of the electron projection "gun," which produced pictures on a large screen. Mobile television pick-up vans were being assembled in Camden for NBC. The first units

1) RCA mobile television pick-up units, built in Camden for NBC, made their first appearance on the streets of New York on December 12, 1937.





2

appeared on New York City streets on December 12, 1937. The Iconoscope was further developed in 1937, resulting in sensitivity 10 times greater than before.

A new television transmitting antenna for the Empire State Building was built at RCA Camden and installed in 1938. Studio and transmitter equipment were produced for the Columbia Broadcasting System (CBS) television station in New York, also in 1938.

The first major dramatic star to make an appearance on television in the United States was Gertrude Lawrence, who played scenes from the Broadway hit Susan and God at NBC's Radio City studios on June 7, 1938. Two months later, NBC conducted the first televised sidewalk interviews, with the help of passers-by in Rockefeller Plaza.



2) Large images produced by a newlydeveloped RCA Kinescope projector tube, developed in Camden, April 1938.

3) Iconoscope television camera, produced by RCA Camden for field use, April 1938.

The AMTORG Project (1936-1938)

By the late 1920's RCA had become a recognized world leader in communications-electronics. The Soviets were well aware of the technical advances made by RCA, GE and Westinghouse in radio and experimental television. They also knew the political importance of radio broadcasting. In 1929 RCA entered into an agreement with the Union of Soviet Socialist Republics to exchange technical information. This action was preapproved by the Army, Navy and State Department.

The first visit by a RCA Victor Company engineer to the USSR occurred in 1930. Loren Jones, development engineer at the General Research Lab in Camden, traveled solo to Moscow and Leningrad. Jones found Russian scientists and engineers eager to learn. Their 100-kilowatt transmitter near Leningrad, although a brute force design, was the most powerful in the world at the time. Information exchanges continued that year, but the Soviets made no equipment purchases from RCA.

In 1936, the Soviets once again approached RCA to exchange technical information. They had a particular interest in the first transmitter designed and installed in the Empire State Building by RCA in 1934. Sarnoff once again agreed to assist the Soviets, but this time under the condition that they purchase about one million dollars of equipment. The Army, Navy and State Department approved the deal. The Soviets ordered a complete television station for Moscow, with the transmitter patterned after RCA's in the Empire State Building.

The contract, known as the AMTORG Project, commenced in 1936. AMTORG was the name of the Soviet trade agency in New York which purchased US technology. (The word "AMTORG" is a Russian acronym for "American Trade"). In addition to the main transmitter for Moscow, the Soviets ordered aircraft transmitters, relay equipment and television receivers. The contract also called for RCA personnel to train Soviet engineers to manufacture their own television receivers and tubes, as well as radio receivers.

Loren Jones led the project, assisted by 11 other top RCA engineers. Soviet representatives observed the design and production of the transmitter equipment at Building #53 in Camden. The equipment was ready for shipment in mid-1937 and the 12 RCA engineers left for the USSR in June 1937. They taught televi-





- 1) Loren Jones (left), AMTORG project manager, entertaining two soviet scientists at RCA Aviation Radio Headquarters, Central Airport, Camden in 1936. The Soviets remained at Camden to observe the equipment design and manufacturing through 1937.
- 2) One of the AMTORG television receivers, using the Kinescope picture tube, produced in December 1936. The image was viewed through a mirror mounted on the lid.
- 3) The 330-ft Shukov Tower in Moscow, prior to the 1937-38 installation of the RCA Camden television transmitter antenna. The tower was constructed from old, rusted steel railroad tracks.

sion receiver and tube manufacturing in Leningrad and radio receiver manufacturing in Veronez. This was not an opportune time to be in the USSR; the height of the infamous "Stalin Purges." The relationship between the RCA and Soviet engineers was cordial but formal. Living in fear of the Stalinist regime, the Soviet engineers were reluctant to become too friendly with the visiting Americans from RCA.

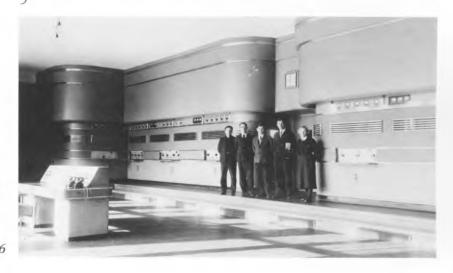
The project was completed in 11 months, and the RCA engineers were paid in full prior to their departure in May 1938. Having made further technical advances through this project, RCA was prepared to introduce television to the American public less than a year later.



- 4) Loren Jones, working in his third floor room of the Metropol Hotel in Moscow under the "watchful eye of Josef Stalin," 1937. The huge canvas of Stalin was produced for an upcoming parade.
- 5) Five of the 12 RCA Camden and Harrison, NJ engineers in the USSR, 1937-38, (l-r): Loren Jones (Moscow), Thomas Eaton (Leningrad), Dr. Henry N. Kozanowski (Moscow), John Read (Veronez), Waldamar Poch (Moscow).
- 6) Soviet engineers, posing with their newly-installed transmitter in Moscow, 1938. The Soviets installed the equipment, guided by photographs showing the progressive stages of assembly in Camden. Photos courtesy: Loren Jones.







Birth of the Television Industry (1939)

After four years of intensive development and field tests by RCA Camden and NBC, the company was prepared to introduce television to the American public.

On April 20, 1939, David Sarnoff officially dedicated the RCA Exhibit Building at the New York World's Fair. His speech, "The Birth of an Industry," was recorded by RCA television cameras and transmitted via the Empire State Building antenna to Radio City. Here, on the 62nd floor of the RCA Building, members of the press witnessed the televised images of Sarnoff—eight miles from the actual ceremonies.

Standing before the microphone, Sarnoff announced:

"Today we are on the eve of a new industry, based on imagination, research and accomplishment. We are now ready to fulfill the promise made to the public last October when, after years of research, laboratory experiments and tests in the field costing millions of dollars, the Radio Corporation of America announced that television program service and commercial television receivers would be made available to the public with the opening of the New York World's Fair..."

"And now we add radio sight to sound. It is with a feeling of humbleness that I come to this moment of announcing the birth in this country of a new art so important in its implications that it is bound to affect all society. It is an art which shines like a torch of hope in a troubled world. It is a creative force which we must learn to utilize for the benefit of all mankind."

In addition to Sarnoff's dedication, the public received a presentation by Lenox Lohr, president of NBC. The ceremonies concluded with a broadcast of a boxing match between two New York amateurs.

On that same day and the day following, RCA gave special television demonstrations to over 2000 RCA Victor dealers from the New York and Newark areas.

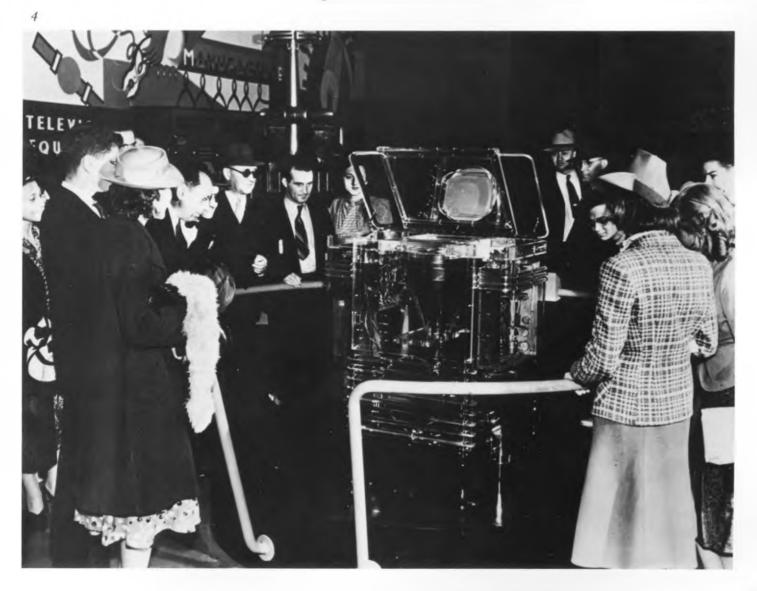
Ten days later, NBC began the first regular public television program service in the United States, when it broadcast the official opening of the New York World's Fair by President Franklin Delano Roosevelt. The historic broadcast was viewed on receiving sets throughout the New York-Newark metropolitan area.





- 1) David Sarnoff, president of the Radio Corporation of America, dedicating the RCA Exhibit Building at the New York World's Fair, April 20, 1939. The ceremony, covered by NBC, was the first televised news event in America.
- The New York World's Fair opened on April 30, 1939. The ceremony, televised by NBC, featured President Franklin Delano Roosevelt. He was the first American president to be seen on television.
- The RCA Exhibit at the 1939 New York World's Fair.
- 4) A full-scale, glass-enclosed 8x10-inch television receiver attracted the attention of hundreds of thousands at the RCA Exhibit, New York World's Fair, 1939-40. Courtesy: David Sarnoff Research Center.



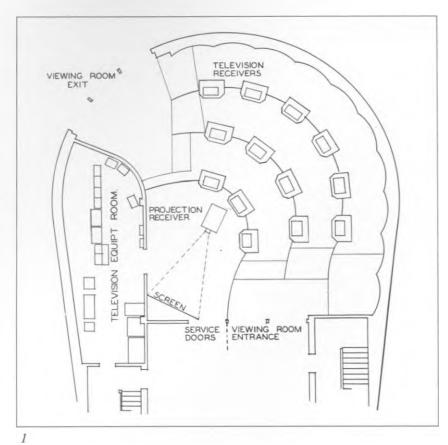


The first commercial television sets were being manufactured at RCA Camden in 1939. Four models were introduced for sale that year: the TT-5, a table-top set with a five-inch Kinescope screen; the TRK-5, a console set with a five-inch screen; the TRK-9, a console set with a nine-inch screen; and the deluxe console model TRK-12, with a twelve-inch screen, viewed indirectly through a lid-mounted mirror.

Manufacturing of commercial television station equipment had also begun at RCA Camden. Television transmitters and associated equipment were announced for sale to the American public in 1939.

Following the inauguration of the first regular public television program service by NBC at the New York World's Fair, television milestones came rapidly.

On June 7, 1939, RCA introduced an improved television "eye," known as the "Orthicon." The first public demonstration of high definition television was given by RCA in Philadelphia two days earlier. The engineers in Camden developed a one-kilowatt television transmitter, enabling broadcasters to initiate service at a lower cost.





- 1) Layout of the television viewing and equipment room for the RCA "Hall of Television" exhibit at the 1939 New York World's Fair.
- 2) RCA Victor television consoles (model TRK-12) were demonstrated to thousands of dealers and distributors concurrently with the company's announcement of the first sales to the American public, April 1939.
- 3) The RCA Victor table-top television, model TT-5, was one of the four models introduced in 1939.
- 4) and overleaf: These were the men of the RCA Manufacturing Company, Inc., Camden, NJ responsible for making television a reality. This dedicated team, consisting of many former researchers and engineers from GE, Westinghouse and RCA prior to the move to Camden, brought television from an experimental project in 1928 to a commercial product in 1939. These portraits were gathered into a book that was presented to the FCC on the occasion of their inspection of television at the Camden Laboratories in 1940. Courtesy: Felix Cone.





FROM THE

AND THE

BCA MANUFACTURING CO., INC.

CAMDEN PLANT







NBC achieved a number of television broadcasting "firsts" in 1939. On June 10, King George VI and Queen Elizabeth were televised on the occasion of their visit to the New York World's Fair. The first televised major league baseball game, between the Brooklyn Dodgers and Cincinatti Reds at Ebbets Field, occurred on August 26. On September 30, the first college football game, Fordham vs Waynesburg, was televised by NBC in New York.

RCA celebrated its twentieth anniversary on October 17, 1939, with the reception of television signals from New York on a United Air Lines plane over Washington, DC. The transmission was received at a distance of two hundred miles and a height of 20,000 feet. The plane, carrying an RCA Camden-built receiver, was also able to see itself land in a second demonstration using cameras on the ground below. These pioneering tests provided a foundation for subsequent intensive development of airborne television for the US Government during World War II.

A final highlight of RCA television developments in the 1930's was the first demonstration of portable television equipment to the FCC, performed on December 1, 1939.

Pioneering in FM

While television research was keeping many engineers at the RCA Camden Laboratories busily employed, others were involved in pioneering research for FM (Frequency Modulation) broadcasting.

From 1930 to 1933, RCA and NBC were engaged in extensive research on FM transmissions between California and New York. In 1934, work began in Camden on specific FM circuits and propagation characteristics of Very-High Frequencies (VHF). By the late 1930's, RCA engineers had invented the Seeley discriminator for FM receivers, the Crosby FM transmitter, and the FM turnstile antenna. The latter was the brainchild of George H. Brown, head of television antenna research in Camden.

NBC conducted extensive field tests of FM broadcasting in 1939, applying to the FCC for an FM station license in July of that year. On January 11, 1940, NBC station W2XWG became the first established FM station in New York. FM broadcasting on a commercial basis was authorized by the FCC in May, and RCA began offering FM transmitters for sale.

The Electron Microscope

Dr. V.K. Zworykin and his associates at the RCA Laboratories in Camden, continuing efforts begun by German scientists, began research in 1938 on what was to become one of the most revolutionary scientific instruments of the twentieth century. In December 1939, at the annual meeting of the American Association for the Advancement of Science, Zworykin announced the ongoing development of a practical electron microscope. The microscope enabled researchers to study, for the first time, viruses such as influenza and other infinitismal objects. Zworykin hired a young engineer named James Hillier who had been involved in electron microscope research in Canada. Hillier produced the first practical model for RCA. It was completed in April 1940, attaining magnifications of more than 200,000 diameters. By the mid-1950's, over 500 electron microscopes were produced by RCA Camden for industrial and scientific use worldwide.

1) Drs. V.K. Zworykin (standing) and James Hillier with the RCA electron microscope in Building #6-2, Camden, NJ, November 1940.



Other RCA Highlights (1935-1939)

Besides the multitude of achievements in radio, phonograph and television by the RCA Manufacturing Company, a number of highlights by other RCA activities between 1935 and 1939 are worthy of mention.

The Radiomarine Corporation of America introduced an automatic SOS alarm for use on ships without a radio operator on constant watch in 1935. Improved radio direction finders and radio telegraph equipment were also introduced that year.

Also in 1935, NBC opened a second Pacific Coast network, thus providing two complete coast-to-coast networks. The two networks together consisted of 94 total stations in 72 key cities, and served 95 percent of the radio families in the United States. On September 29, a series of weekly broadcasts, featuring world-famous artists and entertainers, was inaugurated by NBC. Known as *The Magic Key of RCA*, the series was carried each Sunday on the nation-wide NBC-WJZ network (including Honolulu and Canada).

RCA Communications, Inc. (RCAC) introduced the first three-channel multiplex capability in 1935, in the New York-San Francisco circuit. Another unique RCAC accomplishment that year was the successful handling of a three-way radio conversation between the *China Clipper*, over the Pacific, a San Francisco broadcasting studio and the National Geographic Society's stratosphere balloon over North Dakota.

In 1936, RCAC introduced a 200-kilowatt short wave radio telegraph transmitter, a direct contrast to the 200-kilowatt long wave Alexanderson alternator. The new transmitter employed a directive antenna and was approximately 500 times as effective as the Alexanderson system. RCAC broke all previous records in international broadcasting in 1936, providing 514 broadcasts from 51 different countries.

NBC celebrated its tenth anniversary in 1936; its program service rendered to 111 network stations. The first full-size symphony orchestra organized exclusively for broadcasting was introduced by NBC under Maestro Arturo Toscanini on November 2, 1937. Forty-one new stations were added to NBC's networks in 1937, bringing the total to 143 stations. Short wave broadcasting by NBC to foreign countries became a regular service in 1937. From 184 international broadcasts in 1936, the total increased to 3,179 in 1937 and 16,500 in 1938.

The RCA Institutes, Inc. inaugurated the "RCA Institutes Technical Press" in 1936, which founded the *RCA Review*, a technical journal of the company's progress in radio. The Institutes also offered its first electronics courses for high school seniors in 1936 and the first television courses to the industry in 1938.

In 1937, RCAC inaugurated UHF radio control of its New Brunswick, NJ transmitter, discarding its former use of wire lines. A New York-Iceland circuit was added by RCAC in 1937, bringing its total direct international coverage to 43 countries.

Radiomarine entered the field of radio telephony in 1937, perfecting equipment for use on steamers of the Great Lakes in 1938.

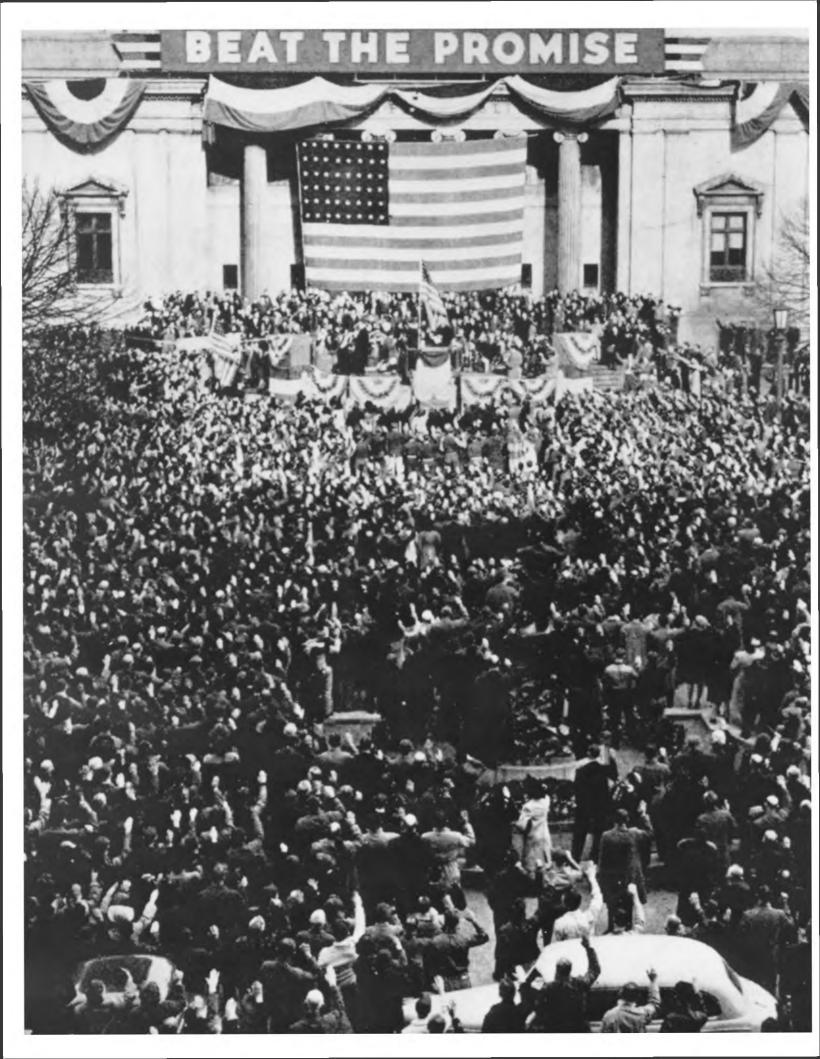
NBC introduced a new short wave "steerable" antenna in 1939, making possible multi-directional transmissions without the use of elaborate mechanical equipment to change the direction of the beam. NBC also led the way in short wave broadcasting to Latin America, transmitting 63 hours of programs a week in Spanish, Portugese, French, German, Italian and English in 1939. The world's first broadcast reports on the 1939 German invasion of Austria were also by NBC.

Financial Summary (1930-1939)

RCA experienced many financial growing pains throughout the 1930's. Entering the decade with sales of \$137 million in 1930, the combined events of the Great Depression, the Government anti-trust suit and heavy investments in plants, equipment and research had a significant negative impact. Sales dropped to \$102 million in 1931, \$67 million in 1932 and \$62 million in 1933. The number of employees in 1930 was 22,000. This figure dropped to 15,000 in 1931 and 12,000 in 1932. In 1933, partly due to the gain of former GE and Westinghouse employees from the settlement of the Government anti-trust suit, total employees increased to 20,000.

Sales totals recovered modestly throughout the rest of the decade: \$78 million in 1934, \$89 million in 1935, \$101 million in 1936, \$112 million in 1937, a drop to \$99 million in 1938, and another recovery to \$110 million in 1939. Total employees were 18,000 in 1934, 23,000 in 1935, 21,000 in 1936, 18,000 in 1937, 19,000 in 1938 and 23,000 in 1939.

Financial turmoil in the 1930's turned into financial growth in the early 1940's. The cause of the turnaround was a shift to major production programs for the US Government in World War II.



Chapter 6

In Service to the Nation (1940-1945)

"All our facilities and personnel are ready and at your instant service. We await your commands."

> — David Sarnoff RCA Radiogram to President Franklin D. Roosevelt December 7, 1941

nly five months after television was introduced to the American public, another historic event diverted its attention to the international scene. On September 1, 1939, Adolph Hitler's Nazi Germany invaded Poland. England and France declared war on Germany and the Second World War had begun.

The Radio Corporation of America was quick to respond to the US Government's call for increased defense research, development, production and service. The National Broadcasting Company brought the news to millions of homes across the country through radio broadcasting. The RCA Institutes stepped up courses in electronics for US servicemen and women. Trans-oceanic, ship-to-shore and ship-to-ship services by RCA Communications and Radiomarine became increasingly devoted to the military. The facilities of the RCA Manufacturing Company in Indianapolis, IN; Harrison, NJ and Camden, NJ were converted to war production. Likewise, research activities at both Camden and Harrison became intensely focused on defense electronics. The Camden laboratories, responsible for pioneering developments in portable communications gear, microwave relays, radar, sonar and television, applied its expertise to new developments for military use.

"Beat the Promise" Campaign

On September 2, 1941, a new campaign to build morale and camaraderie amongst the 20,000 RCA Manufacturing Company's employees was started. Workers at the Camden and Harrison, NJ, Indianapolis and Bloomington, IN and Hollywood, CA plants assembled to hear the motivating words of David Sarnoff, broadcast over their public address systems:

"Defense has had and will have the right of way in all of our plants and with all of our fellow workers."

At the conclusion of his speech, Sarnoff tapped out the slogan "Beat

Thousands of RCA
Camden employees
gathered at the Cooper
Branch Free Public
Library to pledge
allegiance to the Flag
and to "Beat the
Promise" in producing
radio, sound and
electronic equipment for
the Armed Forces,
December 8, 1941.

the Promise" followed by the letter "B" on a telegraph key at his desk. The message touched off resounding cheers, flag-waving and patriotic music at all five plants. So began the "Beat the Promise" Campaign, whose aim was to instill in each employee the idea of increased production to meet the nation's urgent needs for defense equipment. Thousands of workers signed the following pledge:

"To Uncle Sam:

I pledge myself to put forth my best efforts, not only to fulfill the obligations which we have undertaken to meet the requirements of our National Preparedness Program, but, wherever possible, to BEAT THAT PROMISE!

You and I and RCA"

These inaugural rallies were attended by high-ranking Army and Navy officials, as well as a number of popular radio and stage stars. Lucy Monroe, soprano concert and radio artist, and RCA Victor's Director of Patriotic and American Music; Barry Wood, singer; Lanny Ross, tenor; Ronnie Mansfield, radio celebrity, and others led the singing at the different plants. The crowds stood at attention and joined Miss Monroe in singing "The Star Spangled Banner." The campaign song "Gonna Beat the Promise," sung to the tune of "Casey Jones," was heard by neighboring plants blocks away.

The "Beat the Promise" campaign required weeks of intensive preparation for its successful launching on September 2. A central coordination committee was set up at the Camden plant, with similar units established at the other four facilities. The committees attracted initial employee interest through effective use of internal advertisements to invoke curiosity. Mid-August paychecks were attached to a radiogram from George K. Throckmorton, president of the RCA Manufacturing Company with the following message: "Fellow Worker: _....

This is a radio code for a symbol that has tremendous significance to the USA, you and me. You and I will see it, hear it, strive for it and learn more about it soon."

Shortly afterward, posters containing just a large "B" and the Morse code of a dash and three dots, appeared in all five plants. Finally, the letter and accompanying symbol were explained in the first issue of a new publication called *Beat the Promise*.

The company began awarding life-size cutouts of Uncle Sam each week to the best performing departments in war production. Departments falling behind production sched-



BEAT THE PROMISE

1) RCA Radiogram sent to the White House on December 7, 1941, the day the Japanese attacked Pearl Harbor.

2) One of the series of morale-building posters displayed throughout the five RCA Manufacturing Company plants during World War II.

ules received a life-size cut-out of a sleepy Rip Van Winkle, accompanied by the words: "Wake Up; Uncle Sam Needs You."

As an additional incentive, RCAM President Throckmorton awarded his "President's Flag" once a month to the plant with the best performance. The number of employee suggestions for improvements and cost savings increased dramatically. By November 1941, 36,872 suggestions were turned in by employees of the five plants. Of that total, 26,484 came from the 13,000 employees at the Camden plant.

1





- 3) Over 16,000 RCA employees at Harrison, NJ pledged their commitment to the war production effort on December 8, 1941—the day Congress declared war on Japan.
- 4) Successful results of the RCA Manufacturing Company's first "Beat the Promise" campaign won recognition by the US Navy, who presented the coveted "E" pennant, signifying "excellence" in war production. The flag was presented to RCA Manufacturing employees at a huge rally held in Convention Hall, Camden, January 29, 1942. Harry E. LeRoy (second from left), manager of the special apparatus department and Rear Admiral W.C. Watts, USN (retired) (third from right) presented the flag to merit award winners (l-r): George Lindner, Robert Chilcott, Eleanor Macrina, Thomas Muckenfuss, John Coffee, Henry Thaidigson and Peter Kuss.

The campaign was accelerated on December 8, 1941, the day after the Japanese attacked Pearl Harbor. Huge rallies were again held at the five plants, where thousands more took the pledge. By January 1942, RCA's output of military equipment was three times heavier than it was a year earlier. The Camden plant had impressive output scores: 120 percent in shipping, 163 percent in repairs, 130 percent in amplifier production, 120 percent in transmitter production and 146 percent in advertising and mailing.

A second "Beat the Promise for Victory" drive commenced on February 1, 1942 and the momentum continued to build. The positive results were measured by improved quality control, lower production costs and heightened employee morale.

So successful was the campaign that Army and Navy officials requested copies of the company's promotional material to pass on to other industrial organizations involved in war production.

The third and most memorable "Beat the Promise" campaign was launched on September 13, 1942 with, perhaps, the largest gathering ever for a production rally. More than 60,000 workers from the Camden-Philadelphia area, their families and friends poured into the newly-completed Garden State Park, Delaware Township, NJ for the action-packed event. Sponsored by the RCA Manufacturing Company's joint management-labor War Production Drive Committee, the program included speeches by RCA's President Sarnoff; Donald M. Nelson, Chairman, US War Production Board (speaking from NBC Blue Network studios in New York) and Daniel W. Tracy, US assistant secretary of labor. Other attractions included personal appearances by American and visiting Soviet war heroes, a dive bomber demonstration, a joint war show by the Army and Coast Guard, a horse race, fireworks and musical entertainment. A new slogan was the underlying theme of the day: "The Second Front Depends on the Home Front! Beat the Promise!"

- 1) Transmitter manufacturing in Building #53, RCA Camden, November 1941.
- 2) Transformer assembly in Building #10-6, RCA Camden, March 19, 1942.









The objectives of the RCA "Beat the Promise" campaigns were to motivate employees to 1) Meet and beat production schedules for military equipment, 2) Conserve vital materials, tools, machinery and time, 3) Be on time to work each day and make every minute count and 4) Suggest ideas that could speed production or conserve materials. All objectives were successfully reached throughout the war. The outstanding performance by RCA's research, manufacturing and service activities during World War II were recognized by the Government as among the best in the nation's industry.







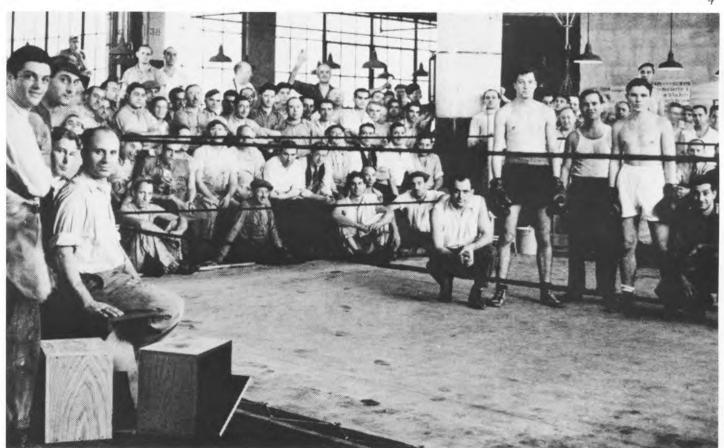
- 3) Radio component manufacturing in Building #13-6, RCA Camden, March 19, 1942.
- 4) Packaging of spare parts for shipment in Building #1-5, RCA Camden, May 1, 1942.
- 5) Small parts punch presses in Building #13-7, RCA Camden, June 7, 1942.
- 6) Studio phonograph consoles undergoing inspection in Building #17, RCA Camden, April 1942.





- 1) RCA Victor record pressing operations in Building #10, Camden, February 1942. Production for the commercial market ceased in April 1942, and was resumed at the Camden, Indianapolis and Hollywood plants after the end of the war. Record pressing at Camden ended entirely by December 1948.
- 2) On April 22, 1942, the US Government issued a directive to industry to halt production of all commercial radio and phonograph equipment in order to concentrate on war production. The last radiophonograph to come off the Camden assembly line was presented to the Infantile Paralysis Foundation in the presence of RCA and Government officials.
- 3) Spray booths in Building #17-6, Camden, for painting electronic equipment boxes, August 1942.
- 4) A popular lunchhour attraction at the RCA Camden plant, which began in the 1930's and continued throughout the 1940's, were the employee boxing matches held in Building #17.





1) One of 1942's major war effort personalities was Lucy Monroe, the RCA Victor Division's Director of Patriotic Music. Known as the "Star Spangled Soprano," she traveled close to 50,000 miles, visiting 24 states. Lucy made over 300 appearances at Army camps, Navy bases, industrial plants and patriotic rallies.

2) Lucy Monroe, presenting a War Bond flag to the RCA Victor Division in recognition of outstanding achievement in supporting the US war effort, July 1942.





21/







- 3) The customized RCA Victor mobile demonstration unit, used as the headquarters for Lucy Monroe's traveling show in 1942. The unit was used as part of the RCA Worker Morale Building Program during World War II.
- 4) An interior view of the customized RCA Victor mobile demonstration unit, 1942. Note the displays of RCA Victor recording artists and the record manufacturing process.
- 5) Another view of the demonstration unit's interior, displaying the familiar moralebuilding posters used throughout the RCA Victor Division's five plants, August 1942.



1

1) RCA's third "Beat the Promise" campaign, to stimulate war production, was launched with great fanfare on September 13, 1942, with a gathering of 60,000 patriotic Americans at the newly-completed Garden State Park., Delaware Township, NJ. Photo courtesy: Vilma Gambino.





STANDARD TIME INDICATED

160 W. 48th ST.
NEW YORK CITY
BR. 9-1269 LO. 5-8064
TELEPHONE YOUR TELEGRAPH
TO POSTAL TELEGRAPH

Form 16



THES IS A PILE WITE TREETING COM-CRAIN OF REPORTAL THE PRESENCE OF HE THE ECONOMIC THE PRESENCE OF HE THE ECONOMIC THE MICHAEL SYMBOLD PROVINCES OF THE MICHAEL SYMBOLD PROVINCES OF THE MICHAEL AND CUTTING HE THE COMPANY IS TARRYS ON HAND AT EACH OFFICE AND ON FILE WITH MICHAEL TOWN AUTHORITIES.

N. WA444 (TWO) GOVT TWS PD 3 MINS=PG WASHINGTON DC 21 356P
TO THE MEN AND WOMEN OF RADIO CORPN OF AMERICA=

(NEWYORK NY)=

DEC 21 PM 10

ON THIS SACRED DAY OF OUR LORD WE. THE SOLDIERS ON THE FIRING
LINE. GIVE THANKS TO YOU SOLDIERS ON THE PRODUCTION LINE FOR
THE SINEWS OF WAR THAT MAKE VICTORY POSSIBLE. WE ARE DEDICATING
THIS CHRISTMAS DAY TO THE DEFEAT OF OUR ENEMIES——YES.
THIS CHRISTMAS DAY, THE DAY AFTER AND EVERY DAY THEREAFTER
UNTIL WE ESTABLISH PEACE ON EARTH AND GOOD WILL TO MEN=
"MACARTHUR."



- 2) On December 7, 1942, during a huge rally of RCA Camden workers at Johnson Park, Navy Commander J.F. Bates presented the Army-Navy "E" flag with star to Arnold Weber and Giles Frazier. This was already the third award to the Camden plant from the US Armed Forces for excellence in war production.
- 3) This Christmas message to RCA Victor's "soldiers on the production line" from General Douglas MacArthur was received by RCA in New York on December 21, 1942.
- 4) President Roosevelt presenting the War Production Board's highest award for Industrial Production Merit to RCA Service Company's Edwin C. Tracy at the White House, January 1943. Stanley Crawford (left background) also received a certificate for Individual Production Merit.



The Formation of RCA Laboratories (1941)

To centralize its research activities for national defense, RCA formed RCA Laboratories as a new division in 1941. The company purchased 260 acres of farmland and two farmhouses in Princeton, NJ on March 11, 1941. One of the reasons for the selection of Princeton as the site was that it was midway between the principal plants at Harrison and Camden. It was also conveniently close to the corporate offices and NBC in New York City.

Ground was broken for the new Laboratories on August 8, 1941 by Dr. Otto S. Schairer, vicepresident in charge of RCA Laboratories, and RCA President David Sarnoff. The building was completed 14 months later and formally dedicated on September 27, 1942 "to increase the usefulness of radio and electronics to the Government, to the public and to industry." The initial technical staff consisted of 125 scientists and engineers from Camden and Harrison. Many of the early developments at Camden were brought to Princeton for applications to national defense. Acoustics research led to development of a searchlight variation of sonar and a depth charge for submarine warfare. Airborne radar systems were developed for improved bombing and automatic control techniques. Continued antenna research resulted in the development of the "slot" antenna for high-speed military aircraft. Infrared sensitive tubes were engineered for night vision applications. The "Sniperscope" and "Snooperscope" devices were two effective products resulting from such innovative research. Development of the Image Orthicon, started at Harrison in 1941, became a highlight of wartime research at Princeton. Television developments at Princeton were preceded, however, by a number of milestone achievements at Camden and New York in 1940-1941.

- 1) Dr. Otto S. Schairer, VP in charge of RCA Laboratories (right) looks on as David Sarnoff, RCA president,. breaks ground for new laboratories in Princeton NJ, August 8, 1941. Courtesy: David Sarnoff Research Center.
- 2) RCA Laboratories was opened on a 260-acre farmland site in Princeton, NJ in 1942. Its initial staff consisted of 125 scientists, most from the research laboratories of RCA Camden and Harrison, NJ. This photo was taken on April 22, 1942, five months prior to completion of the facility.



RADIO CORPORATION of AMERICA



1) Research in optics and infrared techniques at RCA Laboratories led to the development of the "Snooperscope" (top) and "Sniperscope," which were used for night reconnaissance and combat by US forces in the Pacific during World War II.

Television Developments (1940-1941)

On February 6, 1940, the Federal Communications Commission received a demonstration of color television at RCA Camden. The color images were produced by electronic and optical means, employing no moving mechanism. The first televised hockey and basketball games, as well as inter-collegiate track meets, were broadcast by NBC from Madison Square Garden. The opening game between the New York Giants and Brooklyn Dodgers was first televised by NBC in April 1940, as was the Ringling Brothers and Barnum & Bailey Circus. NBC's commercial broadcasting also expanded to include religious services, dramatic plays and operatic scenes, all originating from its studios at Radio City.

On March 6, New York City was televised from the air for the first time by a plane equipped with an RCA portable television transmitter. On May 14, a television program broadcast from NBC, New York was received on the USS President Roosevelt 250 miles out at sea.

A temporary setback to commercial television occurred on May 27, 1940, when the FCC ruled a return to experimental operations. NBC, as a result, turned its attention to politics. The Republican National Convention was telecast in New York via coaxial cable from Philadelphia on June 21, 1940. On July 23, NBC made the first test of 507-line television pictures. Election returns were televised for the first time by NBC, when cameras scanned the incoming bulletins on the press teletype machines on November 5, 1940.

A number of RCA milestones in television were achieved on January 24, 1941. Home television receivers with 13.5 x 18-inch translucent screens were demonstrated for the first time to the FCC. The first automatic UHF relay between Camp Upton, Long Island and New York City was successfully operated. RCA Camden-built mobile television units transmitted pictures via relays at Hauppauge and Bellmore to the RCA Building 68 miles away. The signals were received by a special horn antenna developed at the Camden laboratories. That same day, television on a 15 x 20-foot screen was viewed at the New Yorker Theatre. On February 20, television pictures in color were first broadcast by NBC from the Empire State Building transmitter. This was the first color telecast by mechanical means from a television studio. On May 1, RCA-NBC successfully tested the first projection-type color receiver using mechanical methods. On May 2, 1941, the FCC announced that commercial television was once again authorized, beginning July 1. On that day, NBC launched the pioneering commercial television station WNBT in New York.

The research and manufacturing activities at Camden were instrumental to the achievement of these commercial milestones. More importantly, though, were the efforts devoted to military uses of television.

Airborne Television Projects (1941-1945)

Throughout World War II, RCA Camden developed a wide variety of airborne television systems that played an important part in US military operations. Airborne television was first envisaged in 1934 by Dr. Zworykin at the Camden laboratories. In 1940, he led pioneering field tests using cameras mounted on small, pilotless aircraft. The US Army sponsored the development under heavy secrecy. Known as "Block I," the first airborne camera system was built by RCA Camden engineers in 1940 and delivered to the Army in April 1941 for field testing. Successful results led to a follow-on contract for an improved model, known as "Block III." More than 4,000 were subsequently manufactured by RCA for use in drone aircraft and missiles.

A second airborne television project, known as "Ring," was a high-resolution reconnaissance system for the US Navy. The system, at an altitude of four miles, had a range of 200 miles. This project was managed by NBC.

A third project, called MIMO, was the

development of a miniature Image Orthocon camera for glide bombs.

These significant technical advances by RCA were held as secret until March 21, 1946, when a public demonstration was conducted by RCA in cooperation with the Navy at the US Naval Air Station, Washington, DC. The demonstration served to show the world that airborne television was an important wartime technology and a significant development for peacetime applications.

RCA television also played an important role in the US tests of the atomic bomb at Bikini. Remotely-controlled Army planes equipped with television cameras flew through the atomic cloud immediately after the explosion. One camera was located in the cockpit, the other in the nose of the plane. The purpose was to provide telemetering information. The second Bikini test involved RCA television cameras installed on Bikini Island, three miles from the explosion, and RCA television receivers installed in a number of Navy aircraft and ships. Observers aboard the aircraft and ships were able to view the explosion from a safe, long distance away.

1) Dr. Zworykin's proposal for the first TV guided missile was sponsored by the US Office of Scientific Research and Development (OSRD) in 1940. RCA Camden engineers, in coordination with the Bureau of Standards, conducted the first field tests on remotely-controlled "drones" at Muroc Lake, CA (later to become Edwards AFB). The successful tests led to production contracts with both the Army and Navy during the war. Courtesy: Loren Jones.

2) The first airborne television equipment produced at RCA Camden for the US Army Signal Corps' "Block I" program, May 1941. The camera (left) was mounted in the nose of the bomb. The rest of the system consisted of (l-r): a dynamotor, junction box, transmitter and monitor. The pilot guided the bomber aircraft, using the monitor and a joystick. Courtesy: Felix Cone.







- 3) The US Navy Gorgon was a jet-propelled bomb guided unerringly to its target by an RCA Camden television camera mounted in its plastic nose. The flying bomb had a top speed of 550 mph and carried a ton of explosives. This photo was released in April 1946.
- 4) Closed-circuit, miniaturized television cameras were produced at RCA Camden for the US Bureau of Aeronautics during the war. These cameras were placed in the rear gunner's window of the B-17 Flying Fortress bomber to act as a second set of "eyes" for the bomber pilot. The pilot, guided by the camera, remotely controlled the gunfire, eliminating the need for a rear gunner. Courtesy: Felix Cone.
- 5) RCA airborne television equipment, developed in secrecy for the Government during World War II, was demonstrated publicly for the first time on March 21, 1946. The demonstration was held by RCA in cooperation with the Navy at the Naval Air Station, Washington, DC.







RCA Manufacturing Facilities Expansion: The Lancaster, PA Plant (1942)

Due to the rapid advances made by RCA Victor in radar and microwave communications, demand for special purpose radio and electron tubes increased significantly by the early 1940's. The military had an especially urgent need for increased production of these tubes for electronic equipment during the war.

To satisfy the need, the US Navy constructed a modern tube manufacturing plant in Lancaster, PA. Completed in 1942, the plant was operated at full capacity by RCA personnel through the remainder of the war. By 1945, hundreds of thousands of tubes for military electronic equipment had been produced. With the post-war return to commercial television development, RCA purchased the Lancaster plant from the Navy for use as a television tube manufacturing facility.

RCA Service Company Organized (1942)

To satisfy the increasing demand for installation, operation, maintenance and training for its fielded products, RCA organized a new and wholly-owned subsidiary. The RCA Service Company, Inc. was organized on December 24, 1942, assuming all activities previously conducted by the Service Division of the RCA Manufacturing Company.

2) On April 24, 1944, the RCA Victor Division's Lancaster, PA plant became the fourth to receive the Army-Navy "E" Award for Production Achievement, following Camden, Harrison and Indianapolis. Holding the "E" flag were (l-r): J.A. King, Lancaster plant manager; Captain L.B. Blaylock, US Navy; Brigadier General John H. Gardner, US Army, and Walter L. Kohr, president of Local B1165, I.B.E.W.

The RCA Service Company's actual beginnings date back to 1921, with the first activity established to repair Radiolas. The group expanded with the additions of the installation and service activities of RCA Photophone, Inc. (1928) and the Service Department of the Victor Talking Machine Company, which became the Service Division of RCA Camden in 1930.

Formation of the RCA Victor Division (1942)

By 1942, the RCA Manufacturing Company Inc. was a 30,000-employee organization with plants at Camden and Harrison, NJ, Indianapolis and Bloomington, IN, Hollywood, CA and Lancaster, PA. To facilitate coordination of manufacturing activities for war production, the RCA Manufacturing Company was merged into its parent company, the Radio Corporation of America, on December 31, 1942. The new organization became the RCA Victor Division.

George K. Throckmorton, former chairman of the executive committee of the RCA Manufacturing Company, was elected a vice-president of the new RCA Victor Division. 1) In 1942, the US Government built a new plant in Lancaster, PA for RCA to manufacture television tubes for wartime use. This became the sixth plant of the newly-organized RCA Victor Division. At the end of the war, RCA purchased the Lancaster plant from the Government and began production of television tubes for the newborn commercial market.



The Proximity Fuse

In November 1941, RCA Victor scientists and engineers began work on a project which was to become one of the nation's most effective weapons in World War II. Ten months later, working in cooperation with the Navy's Bureau of Ordnance and the Office of Scientific Research and Development, production began on the "variable-time" or "V-T" fuse. Known also as the "proximity" fuse, this miniature instrument was no larger than a pintsize milk bottle, enclosed within the case of a five-inch shell. It consisted of either a four or five-tube radio receiver and transmitter employing radar principles. When fired, the fuse emitted radio waves which bounced off the target and reflected back to the receiver. As the shell approached closer to the target, the returning signal grew stronger until it engaged the detonating mechanism. The shell, therefore, exploded at the point of maximum destructiveness, just prior to impact.

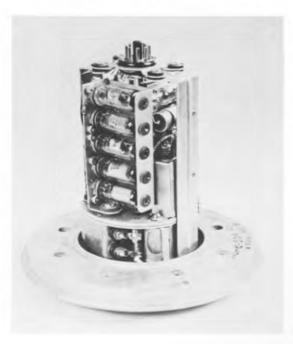
Thousands of RCA employees produced the fuse in the company's plants at Bloomington, IN and Camden, NJ (Building #8). Although they assembled more than 18,000 a day at the height of production, they knew only that the project was called "Madame X." So secret was this technology, the employees had no knowledge of the application of this devastating device.

Described as one of the most effective weapons developed in World War II, the proximity fuse was used in both Army artillery shells and Navy projectiles. It was successfully used by the Allies in Great Britain,

beginning in June 1944, to shoot down the infamous German V-1 bombs launched from France.

Ten million of these fuses were produced nationally from October 1942 until V-J Day. Of this amount, RCA Victor supplied five and a half million, making the company the largest producer in the country.

By 1945, the Navy awarded the Bloomington plant the Navy Ordnance Flag with three stars. The Camden plant, which already had an Army-Navy "E" Flag with four stars for other outstanding achievements, was also awarded the Navy Ordnance Flag with one star for its superior fuse production record.



- 1) The "variable-time" or "proximity" fuse, was one of the most effective weapons to emerge from the Second World War. RCA Victor produced five and a half million at the Bloomington, IN and Camden, NJ plants, making the company the largest producer in the United States.
- 2) The RCA Manufacturing Company's Bloomington, IN plant, established in 1940, began production of the V-T or proximity fuse in September 1942. At the end of the war, it received the Navy Ordnance Flag with three stars for its outstanding production record.



Other Product Developments (1940-1945)

Besides the great developments in airborne television and the proximity fuse, a number of milestone achievements were made in electronics for defense, commercial and scientific applications by RCA during the war.

Cooperative efforts between RCA Laboratories and the RCA Victor Division resulted in successful development and manufacturing of radar equipment for aircraft and ships. Long-Range Navigation (LORAN) receivers were mass-produced, based on a design supplied by the Massachusetts Institute of Technology. RCA Laboratories designed, and RCA Camden produced, Short-Range Navigation (SHORAN) systems. SHORAN was a precision radar system employed as an aid to blind bombing missions. The system was so precise, that it could measure distances up to 250 miles with almost pinpoint accuracy.

Research and development work also covered such diverse fields as synthetic quartz crystal production, training devices for use in anti-aircraft firing techniques, improved shipboard battle-announce systems, radio devices to locate enemy mines, and supersonic communications systems.

Further advances were made with the electron microscope. On November 22, 1941, the first photograph of the influenza virus was taken at the University of Pennsylvania with the RCA Camden-built instrument. The microscope also enabled the Government to analyze various metals, oils, chemicals and foods as part of various defense and other research projects. It was also employed with great success on the Manhatten Project, from which evolved the atomic bomb. The microscope also aided in the development of synthetic rubber for vital defense needs.

Radio-frequency equipment for the bulk dehydration of penicillin was developed and installed by RCA at the New Brunswick, NJ plant of E.R. Squibb & Sons on May 5, 1944. Research in radio-frequency heating for industrial processes found applications in riveting, welding, rare metals melting and plastics molding. A radio sewing machine was developed for bonding thermoplastic materials for war uses.

Developments for the commercial market included the first pocket-sized "personal" radio in 1940 and the RCA Alert Receiver, an air raid warning device for civil defense use. Designed for commercial use at RCA Camden, the Alert Receiver was first demonstrated on July 28, 1941

in New York City by David Samoff and New York's Mayor Fiorello LaGuardia. Production began in Camden in November 1941.

RCA Victor recordings and recording apparatus were produced during the war for use by the US Office of War Information. Public address systems built at the Camden plant were installed in factories, shipyards, docks and elsewhere on the domestic production front. RCA Victor musical recordings were played over these public address systems to boost worker morale and stimulate war production. A final noteworthy achievement by RCA during the war was the development of the 8D21 transmitter tube, which put television on the air over the entire VHF spectrum immediately after the war

1) A new all-plastic altitude test chamber, developed at RCA Camden in 1942, allowed engineers to perform pressure tests of aircraft radio equipment at simulated altitudes of 40,000 feet.



.







RCA Contributions to Victory

The Radio Corporation of America had a distinguished record of service to the nation during World War II. All divisions of the company - research laboratories, manufacturing plants, broadcasting and communications facilities - devoted their operations to the war effort.

The RCA Laboratories, initially at Camden and Harrison and later at Princeton, NJ, developed Short-Range Navigation (SHO-RAN), airborne radar, airborne television, electronic fire control and guided missile systems.

The RCA Victor Division's six plants at Camden and Harrison, NJ, Lancaster, PA, Indianapolis and Bloomington, IN and Hollywood, CA fulfilled their missions to "Beat the Promise" in the production of radio, television, radar, sound, fuse and other electronic equipment for the US and Allied Forces. Notable achievements included 200 types of electron tubes, 20 million miniature tubes, five and a half million proximity fuses, radar altimeters, sound-powered telephones, battle announce equipment, television tubes, and radio frequency (RF) power generators.

RCA Communications provided the only initial means of communications between the US and the war zone, and maintained operation of vital networks throughout the war. Notable milestones included the first radiophoto circuits opened between the US and

- 2) RCA Aircraft Radio Compass System, model #AVT-8F, was manufactured for military aircraft beginning in September 1942.
- 3) Testing LORAN (Long-Range Navigation) equipment, used on aircraft and ships, at RCA Camden. Designed by MIT, the system was improved by RCA and first produced for use in World War II.
- 4) Staple gun using air compression device developed at RCA Camden, April 1943.

Australia (March 20, 1942); New York and Cairo (June 24, 1942); New York and Stockholm (February 22, 1943); New York and Berne (September 21, 1943); direct radiotelegraph circuits between New York and Dakar (March 10, 1943) and New York and Naples (February 1, 1944). For the New York-Naples circuit, RCA established the first American-owned and operated commercial station in continental Europe.

The Radiomarine Corporation of America produced more than 40,000 major units of marine radio equipment. Forty-two different types of radio and radar systems were installed on merchant and supply vessels.

The RCA Institutes trained thousands of Army, Navy and Marine Corps personnel in radio and electronic techniques throughout the war. The National Broadcasting Company provided global coverage of military operations for broadcast and produced a variety of morale-building programs. NBC newsmen accompanied American troops on every front, from the landings in Africa and Italy to night bombing missions over Germany; from the Pacific campaign to the D-Day invasion of Normandy. At the end of the war, NBC had 65 reporters and

commentators around the world. The NBC News Department had become an international service by 1945, and has remained so to the present day.

For its outstanding performance through the war, RCA was recognized by seven Army-Navy "E" flags, two Navy Bureau of Ordnance flags, the US Maritime "M" pennant, the Victory Fleet flag and 27 stars for continued excellence in operations. Each star represented six months of service. The Army-Navy "E" flags were awarded to the RCA Victor Division, Radiomarine and RCA Laboratories. The Navy Ordnance flags were awarded to the RCA Victor Division's Bloomington, IN and Camden, NJ plants. The Maritime "M" pennant and Victory Fleet flag were presented to Radiomarine. RCA Communications was awarded a Certificate of Appreciation by the War Department. RCA Laboratories also received a Navy citation.

A number of RCA executives and scientists received individual awards for distinguished service, which included Certificates of Appreciation and Medals of Merit from the President. The War Production Board awarded Certificates of Individual Production

1) The first American-owned and operated broadcasting station in continental Europe was erected at Naples, Italy on February 1, 1944 by RCA Communications, Inc. Among those at the site were (l-r): Edward Farnsworth, Niel Beck, Thomas D. Meola and Andrew W. Long.



Merit to numerous RCA Victor personnel for outstanding war production efforts.

RCA President David Sarnoff, in addition to providing corporate leadership, served twice on active duty during the war. He was initially a Colonel in the Office of the Chief Signal Officer in Washington, DC. On March 17, 1944, he was assigned overseas, receiving the appointment of Special Consultant on Communications at Supreme Headquarters of the Allied Expeditionary Force. He was awarded the Legion of Merit on October 11, 1944 for overseas service and was nominated for promotion to Brigadier General by President Roosevelt on November 21, 1944. The nomination was confirmed by the Senate. On February 8, 1946, President Harry Truman awarded General Sarnoff the Medal for Merit for services of "inestimable value to the war effort."

RCA research, engineering and manufacturing groups accepted some of the most complex radio and electronic projects of the Second World War. These groups conducted countless special studies and served on many advisory committees for the Army, Navy and Office of Scientific Research and Development. RCA employees served in every theatre of the war, in both civilian and military capacities. Total employees peaked at 42,000 in 1944. By war's end, 8,559 employees had joined the US Armed Forces and 145 of them gave their lives for their country.

Financial Summary (1940-1945)

The Radio Corporation of America experienced significant financial growth due to its heavy research, development, manufacturing and service activities for the United States in World War II. Following conversion to military activities, sales increased from \$110 million in 1939 to \$128 million in 1940. The annual figure rose to \$158 million in 1941, \$197 million in 1942, \$294 million in 1943 and \$326 million in 1944. With the ending of the war, sales dropped to \$279 million in 1945. After-tax profits rose from \$9 million in 1940 to \$11 million in 1945. Total personnel employed by RCA were 25,000 in 1940, 30,000 in 1941, 35,000 in 1942, 40,000 in 1943, 42,000 in 1944 and 33,000 in 1945.

RCA grew strongly during the Second World War. But this was just the beginning. The post-war years were to usher in a new era for both the company and America, making RCA a \$1 billion enterprise ten years later. The Age of Television was about to begin.



Frau Holtz receives an American guest

in spite of the headsman's axe!

Until Hans died for the glory of the Fuehrer, somewhere on the Russian front two months ago, Frau Holtz knew very little of America...and what little she knew was wrong. Herr Goebbels saw to that.

But when her last son went the way of his two brothers, there were some things she had to know. One night she turned a dial—and brought an American visitor into her home. She turned down his voice to the barest whisper, but she listened all the same. And there came to light within her a dawning realization—a bitter sense of betrayal.

Tonight in Germany, in France, in Czechoslovakia, a thousand Frau Holtzes will listen to the verboten voice of RCA-NBC International Shortwave Stations WNBI and WRCA—even though whip and

bludgeon and axe await them in the dungeons of the Gestapo, if they are discovered.

They hear—at long last—the forbidden truth. Truth hurled from RCA transmitters across the sea—the truth about America—the truth about the world—the truth no tyranny can suppress.

Of all the uses to which RCA Radio Equipment has been put in this war, we are not least proud of this use: that RCA Equipment today is not only helping to overwhelm the physical might of our enemies in war, but is helping, too, to prepare the minds of the world for the just and lasting peace that will come when the war is over. Radio is opening Frau Holtz's eyes to the truth that her enemies are not here, but at home.





- 2) A July 1942 advertisement for RCA Camden Police Radio Systems, highlighting the effective use of radio as a psychological warfare weapon against the Germans.
- 3) Patriotic message from RCA in Radio Age, July 1944, preluding the Age of Television.



Chapter 7

The Post-War Era: Television to Defense Electronics (1945-1955)

"RCA and NBC have the know-how to broadcast color programs, to build equipment for color broadcasting and to build sets that will receive these color programs. In addition, RCA and NBC have a nucleus of trained personnel ready to do the job."

— C.B. Jolliffe Vice-President and Technical Director of RCA Petition to the FCC — June 25, 1953

he wartime advances in radio, television and electronics brought rapid benefits to the public in the post-war years. From television to defense electronics, RCA was an industry leader during World War II.

Returning to peace, RCA was well-positioned to meet the demands of both Government and commercial customers. The post-war era was one of extensive growth for RCA, from continued defense programs to new products and services for the booming consumer market.

Reconversion to Peacetime Operations

By mid-1945, RCA began plans to reconvert its research, engineering, manufacturing and service facilities to peacetime operations. Wartime production had decreased and it was apparent that victory was near. These plans were immediately implemented following V-J Day. RCA Victor plants at Bloomington and Indianapolis, IN and sections of the Camden plant were producing commercial radio products within eight weeks. The Indianapolis plant manufactured home radios, receiving tubes and phonograph records. The Bloomington plant introduced a new line of compact "personal" radios. The Camden plant was responsible for phonograph records and a variety of electronic equipment for commercial applications.

Commercial receiving tube production resumed at the Harrison, NJ plant by late 1945. The Hollywood, CA plant returned to commercial production of RCA Victor records. The Lancaster plant, built and operated by RCA

An experimental RCA Victor color television receiver, featuring a 21-inch tri-color tube, developed in 1951 to test RCA's compatible, all-electronic color television system. during the war for the US Navy, was purchased in 1946 for production of tubes for television, broadcast transmitters and other industrial uses. Another plant was acquired by RCA in Monticello, IN during the war for low-cost cabinet manufacturing. Virtually all cabinet-making operations were transferred here from Building #17 in Camden, when the latter was converted to defense electronics production.

Sound recording and reproduction equipment for motion pictures, which was devoted to defense needs throughout the war, was rechanneled to the commercial market by 1946. The Hollywood, Indianapolis and Camden plants were all involved. Additional facilities were acquired in Detroit, MI for increased manufacturing capacity for theatre projection equipment. Automobile radio production was resumed at facilities in Chicago, IL and a complete new line of emergency communications equipment for police and commercial vehicles was introduced by the Camden plant.

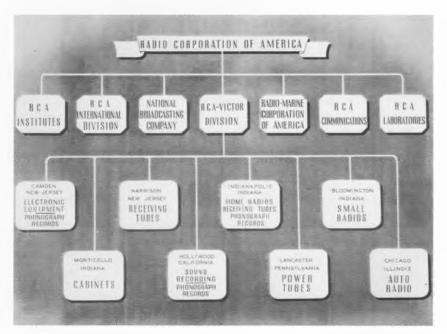
RCA International Division Formed (1945)

During the war, RCA became involved in international activities through lend-lease of electronic equipment to the armed forces of many allied nations. To consolidate its expanding international business toward the conclusion of the war, the corporation established the RCA International Division on February 1, 1945. The new division was responsible for the distribution of products manufactured by RCA and certain non-affiliated companies to foreign customers and for the operation of certain associated companies outside of the United States. By 1953, RCA manufacturing and selling companies were located in Canada, Mexico, Chile, Brazil, Argentina, England, Italy, Spain, Greece, India and Australia. Operating through more than 300 distributors and field representatives, the RCA International Division became well-established in the world market within ten years of its creation.

Post-War Television Developments

Research and engineering advances in television for military applications by RCA during the war were quickly applied to the commercial market following the return to peace.

The supersensitive Image Orthicon tube was introduced to the commercial industry on October 25, 1945. A major demonstration to reveal to the public the pioneering advances made during the war was held at RCA Laboratories in Princeton, NJ in December 1945. An all-electronic blackand-white system, showing greatly improved



1



2

picture quality, was introduced. The images, bright enough to be seen in the fully-lighted room, were received at Princeton from NBC's pioneer station WNBT atop the Empire State Building in New York City, 47 miles away. A mechanical color television system in three dimensions was also demonstrated that day. During the demonstrations, the corporation outlined its plans and policies for post-war television. Highlights of the announcement were that 1) RCA was committed to continued research and development in all areas of television: black-and-white and color transmission and reception, network distribution and programming; 2) RCA Victor Division would

- 1) Organization of the Radio Corporation of America, October 1946.
- 2) Following the war, RCA began to manufacture wood cabinets for radio, phonograph (and later TV) at a new plant in Monticello, IN.

Keep your eye on NBC

On the air FIVE TIMES WEEKLY with a regular schedule of fine



ely, authentic, exciting, the WNBT Telenewsreel



From the live-talent studio in Radio City, especially adapted for NBC television—Broadway hit shows, grapers, variety. A regular weekly feature on WNBT.



Grounds, BOXING twice a week from Madison Square Garden, WRESTLING from St. Nicholas Arena, FOOT-BALL (in season). Regular weekly features on WNBT.



NBC's special children's program to 60---include Quiz shows, i feature shorts, novelties and a special Classroom program connection with the New York Board of Education

. This is but a small sample of NBC's exciting parade of television presentations: cultural and educational topics, special events, newsreels, parades, fashion shows, motion picture features-nou being broadcast on NBC television. Just a hint of the bigger and better television programs on their way to you from NBC.

NBC TELEVISION

NEW YORK

NATIONAL BROADCASTING COMPANY

begin manufacturing television equipment for both the broadcast industry and public; 3) NBC would continue development of its programming service and strive to establish the nation's first coast-to-coast network; and 4) RCA would make available all of its television-related patents to its licensees as it had done previously in other fields of radio-electronics.

Television progress accelerated in 1946, with the establishment of the first network. NBC station WNBT in New York was linked, via coaxial cable, with WNBW, Washington, DC, WPTZ, Philadelphia, PA and WRGB, Schenectady, NY. On June 19, 1946, NBC televised the first world heavyweight championship fight—the Louis-Conn bout at Yankee Stadium—to the New York area and to Washington, DC via coaxial cable.

On September 17, 1946, the RCA Victor Division introduced the first post-war television sets to the public. Produced by the Home Instruments Department at the Camden plant, the model 630TS had a 10-inch picture tube and sold for \$375. Called the "Model T" of television, it was a reliable, high-quality product that took America by storm.

About this time, the first commercial blackand-white, or monochrome, Image Orthicon television camera was introduced. Also produced at Camden, the TK-10 marked the beginning of an era in which RCA would dominate the US television camera market. The TK-10 was for studio use. A modified version, the TK-30, was for field use. The Image Orthicon tubes were supplied by the Lancaster, PA plant.

		PRESI		LEVIS			IGNMEN		ALLOCA	TIONS	
CHANNEL	FREQUENCY BAND IN MEGACYCLES	AREAS & STATIONS				STATION	FREQUENCY	AREAS & STATIONS			
		NEW YORK	PHILA.	LOS ANGELES	CHICAGO	NO.		NEW YORK	PHILA.	LOS ANGELES	CHICAGO
						1	44-50	*	*	*	*
1	50-56	WNBT		KSEE DON LEE	W9XZY ZENITH	2	54-60	WCBW CBS		KSEE DON LEE	W9XZY ZENITH
2	60 - 66	WCBW CBS			WBKB BALABAN KATZ	3	60 - 66		WPTZ PHILCO		
3	66-72		WPTZ			4	66-72	WNBT NBC			WBKB BALABAN KATZ
4	78-84	WA B D DUMONT		W6XYZ TELE. PROD.		5	76-82	WABD DUMONT		7/11/11/11	
5	84-90		W3XEP RCA			6	82-88		W3XEP RCA		

NOT ASSIGNED TO METROPOLITAN AREAS CHANNEL ASSIGNED THIS AREA, BUT NO STATION YET ESTABLISHED.

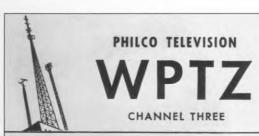
October 1945.

3) One of the first NBC advertisements for postwar television, appearing in Radio Age,

4) Present (left side) and revised assignment (right side) of television broadcast channels in the US as of February 7, 1946. Courtesy: Felix Cone.

TELEVISION ASSIGNMENTS N BY M. P.Cogs. 7 4 7, 1946

™ K•98616



Program Number

12-46

Wednesday, March 20

111111

8:00 P. M.—"Philadelphia Portrait"—WPTZ Magazine
"Bonecrushers Carnival"
8:30 P. M.—ARENA—Ice Hockey—Falcons vs. Lions

Friday, March 22

8:00 P. M.—"Good Little Monkeys"—Animated Cartoon "The Black Coin"—Film Serial "Philadelphia News of the Week"—WPTZ Newsreel "Seven Sinners"—Feature Film

9:45 P. M.—ARENA—Wrestling

Saturday, March 23

8:00 P. M.—"Trailing the Sea Horse"—Novelty Film
"The Violin"—Topical Film
"Mediterranean Milestones"—Travelogue
8:30 P. M.—ARENA—Ice Hockey—Falcons vs. Rovers

PHILCO RADIO AND TELEVISION CORPORATION
Tioga & C Streets, Philadelphia 34, Pa.







- 1) The first "TV Guide" for the Delaware Valley was a listing of programs on a postcard, which was mailed to the few homes that had a set, March 1946. Courtesy: Felix Cone.
- 2) The first world heavyweight championship fight on television was the Louis-Conn bout at Yankee Stadium, New York, televised by NBC on June 19, 1946. Featuring three Image Orthicon cameras, the NBC coverage was broadcast simultaneously by WNBT, New York and WPTZ (Philco), Philadelphia. It was also carried by network hook-up, via AT&T coaxial cable, to Washington, DC. Courtesy: Felix Cone.
- 3) The first field installation and service branch for RCA television sets was opened by the RCA Service Company in a small shop on Skillman Avenue, Long Island City, NY in the spring of 1946.

 Managed by Stan Symolon, the branch installed model 630TS sets beginning later that year.
- 4) RCA Victor table model (630TS) television receivers, with a 6 1/2 x 8 1/2-inch screen, began rolling off the Camden production lines on September 17, 1946.

The television camera was only one piece of the camera "chain," which also consisted of a control panel, a master monitor, a power supply and other peripheral support equipment. All were produced by the Engineering Products Department (EPD) at the Camden plant.

Besides studio equipment, RCA EPD produced entire television transmitter systems for the growing, post-war commercial market. A transmitter system consists of a transmitter, multiplexer and antenna. They were assembled and tested at Building #53, State Street and River Road, Camden, throughout the post-war era, later relocating to a new facility in Gibbsboro, NJ. The RCA TT-5A, a five-kilowatt transmitter, was the first on the market after World War II.

To help the television industry get off to a proper start, RCA invited all of its licensed competitors to a briefing in Philadelphia on August 27, 1947. Frank M. Folsom, who became Vice-President in charge of the RCA Victor Division in 1943, extended the invitations to brief competitors on RCA television and take them on a tour of the Camden factory. They were given blueprints for television receivers and complete lists of material needed to build them. The visitors were told that they could use this information any way they desired. The result was the start of a vigorous competition in the United States, and a booming television industry.

Numerous "firsts" in television were achieved by RCA-NBC in 1947. On June 9, the first showing of American television in Europe was conducted by RCA in Milan, Italy. On July 12, Pope Pius XII was first televised from the Vatican.

Televised pictures of surgical operations were transmitted through the air for the first time by RCA September 7-12, 1947. Members of the American College of Surgeons in the Waldorf-Astoria Hotel viewed an operation from a nearby hospital.

NBC activities in 1947 included the first telecast from Congress (January 3), first pickup from the White House (October 5), first telecast of the World Series of baseball (September 30-October 6) and the Louis-Walcott World Heavyweight Championship fight in Madison Square Garden (December 5).

On February 22, 1948, NBC provided the first telecast of a religious service indoors from Trinity Church, New York. The first telecast of the NBC Symphony Orchestra with Maestro Arturo Toscanini was made on March 20, 1948.



- 5) The RCA TK-10, first commercial black and white Image Orthicon TV camera, was introduced by the Engineering Products Department, Camden, NJ, July 1947.
- 6) The RCA TT-5A five-kilowatt television transmitter was the first on the market at the end of World War II. It was designed and built by the Engineering Products Department, RCA Victor Division, Camden, NJ and introduced in 1946. In the foreground is the TM-6 monitor.





- 1) Television chassis riveting operations at the RCA Victor plant, Camden, the first step in manufacturing television sets, 1946.
- 2) Completed RCA Victor television receiver chassis undergoing final inspection prior to assembly into cabinets in Building #3, Camden, 1946.





- 3) A completed RCA Victor television chassis receives the finishing touch with the insertion of a ten-inch picture tube at the Camden plant, 1946.
- 4) RCA Victor table model television receivers moving down the production lines in Building #3 of the RCA Victor plant, Camden, NJ, January 1949. Television receiver production continued at Camden until 1952, when the operation was discontinued to make way for the expanding defense electronics business.



In June-July 1948, RCA-NBC televised the Republican and Democratic National Conventions at Philadelphia, allowing more people to view the events than the total of all who attended the conventions in the past 100 years.

On August 29, 1948, an estimated two million people viewed an RCA-NBC telecast of combat maneuvers of the carrier *USS Leyte* 20 miles off the coast of Long Island.

Working toward the first coast-to-coast network, NBC established owned-and-operated television stations in Washington, DC (1947), Cleveland (1948), Chicago (1949) and Hollywood (1949). NBC had 25 independent affiliates by 1948. One year later, the number grew to 55.

In September 1948, RCA-NBC instituted simultaneous tests of television program transmissions on two different frequencies as part of a continuing study of UHF propagation characteristics. The first split-screen television image, showing two pictures from different



Television-a Season Pass to Baseball !

Every Insine guitti -skey or siight -phored by the New York Giants, Yankees and Prookless Dodgers will be seen may televining

Owning a television requiver in the New grantteek area will be like having a means pass the new form all three hall belie. Not in other stries.

—BCSs preparations for the future beleevating of Whe

When more than one hame game is on the air, basefull fans can switch from our to the other-use the most counting numeria

These who even BCA Victor television receivers will enjoy brighter, clearer, strates pictures through the exclusive BCA Victor Fee, Witness are tree reaches

1

may that "body" the receiver in time with

To extracts bounded as any other ever as the ever-growing range of toke isome pergrams—small most that receives that bear that most farming nature in television toda— ICA Victor.

When you have an BCA Victor relevanenceiver of radio, so Victoria radio-phosgraph, on an BCA Victor record at a radtable, you know you are getting onethe finest products of its kind science in achieved.

Builte Corporation of America, RCA Building Radio City, New York 20, Listen to the RC, Viene Mirro, Santings, 200 P.M., Easter

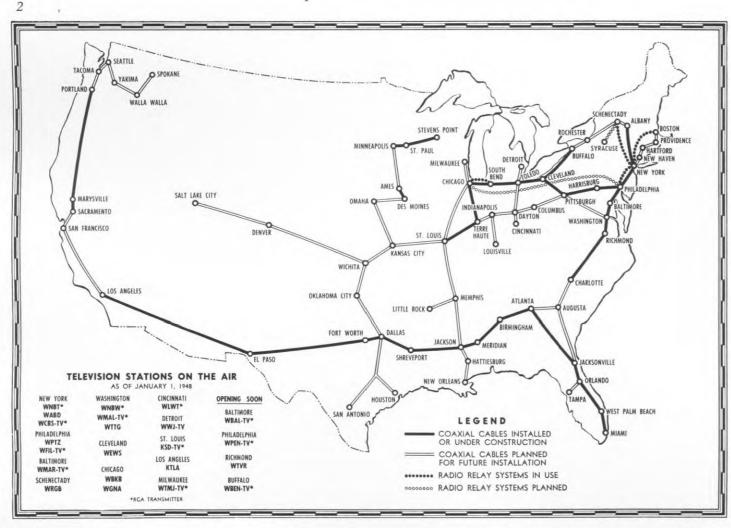


Several Infermion camerias cothe humball diamond to bring to a dissessing of the action where it occurs. Here is a supersensity BCA Image Dichrom belyoncamers used by NBC Sew Ya shattan WNRT as robe using law



1) RCA-NBC brought the first televised World Series to the public in 1947. By 1948, one-quarter of NBC's programming schedule was devoted to sports. Sports coverage was a big selling point for NBC, and ads like this one (Radio Age, April 1947) were run regularly to stimulate interest in television throughout America.

2) Current and proposed US television networks of radio relays and coaxial cables as of January 1, 1948.



,

- 3) A 1948 RCA advertisement for television as a useful medium for shoppers. Courtesy: Anthony D. Ricketti.
- 4) To keep up with consumer demand for television sets, RCA acquired a new plant for tube manufacturing at Marion, IN in 1949.
- 5) The first multiple broadcast antenna system, serving five VHF television stations and three FM transmitters simultaneously, was built by RCA Camden engineers and installed atop the Empire State Building in September 1950.

points-of-origin on the same kinescope picture tube, was displayed at the Television Broadcasters Association Clinic in New York on December 8, 1948.

On January 3, 1949, the RCA Victor Division announced the development of a directview, metal-cone, 16-inch monochrome television picture tube. To meet the growing demand for tubes, a new manufacturing plant was acquired at Marion, IN in 1949.

The inaugural of President Truman on January 20, 1949 was transmitted by NBC from Washington, DC over its 15-station network to



3



over 10,000,000 viewers from Boston to St. Louis.

The commercial introduction of largescreen theatre television was made possible by the signing of a contract between RCA and Fabian Theatres, Inc. on July 27, 1949.

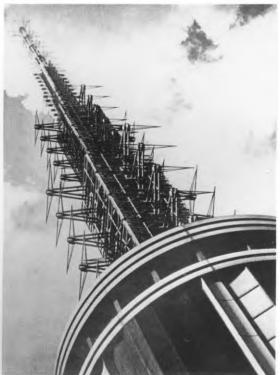
In November 1949, RCA introduced the Antennaplex System, a multiple-outlet master device to solve the problem of multiple television antennas on apartment houses, hotels, stores, schools, hospitals and office buildings. In September 1950, RCA-NBC engineers designed, developed and tested the first multiple antenna system, allowing five television and three FM radio stations to operate from atop the Empire State Building.

Improved monochrome television picture tubes were announced in 1950. First a 17-inch, then a 19-inch kinescope, were developed. In 1951, a 21-inch tube was introduced. By mid-1952, a high-quality 27-inch tube, weighing only 12 pounds, was developed.

The phenomenal post-war growth of television was evidenced by receiver sales in just a few short years. On January 1, 1947, sets in use by the public numbered 16,476. By January 1948, the total was 189,000. A year later it grew to 1,000,000. The 10,000,000 mark was passed in January 1951 and, by 1952, over 15,000,000 sets were in use.











The Engineering Products Department, Camden, NJ began development of a new and improved camera "chain" in 1949. The TK-11 Image Orthicon monochrome studio camera, offering increased performance and reliability over the TK-10, was introduced in 1951. It became the industry standard throughout the 1950's. Advances were also being made by RCA engineers at Princeton and Camden in miniaturized cameras.

2

The Vidicon and "Walkie-Lookie"

In 1949, RCA Laboratories announced the development of a miniature television pickup tube for closed-circuit industrial and educational applications. Dubbed the "Vidicon," the tube could fit into a camera the size of a 16-millimeter personal movie camera. This compact, inexpensive system was first demonstrated to the Institute of Radio Engineers (IRE) on March 7, 1950.

The system was further developed into a one-man backpack unit, called the "Walkie-Lookie," and demonstrated by L.E. Flory to the IRE on March 21, 1951. Weighing 53 pounds, the Walkie-Lookie initially had a range of one mile. It was successfully used at the 1952 Democratic and Republican National Conventions by NBC "roving" reporters. By the mid-1950's, militarized versions were being developed for the US Army Signal Corps for use by soldier-scouts to transmit battlefield scenes to command posts.





- 1) The TK-11 Image Orthicon studio television camera, introduced by the Engineering Products Department, RCA Victor Division, Camden, NJ in 1951, was the successor to the TK-10. It incorporated numerous small changes to improve performance and reliability and a new feature of carrying handles. Together with its counterpart TK-31 field version, the TK-11 became the industry's standard monochrome camera for many years.
- 2) Project team for the RCA Image Orthicon camera "chain," produced by the Camera Equipment Group at Camden (l-r): H.C. Weber, F.E. Cone (leader), R.S. Griswold and A. Reisz. The "chain" consisted of the TK-11 camera, a control panel, a master monitor and a power supply. This new line was introduced in 1951. Courtesy: Felix Cone.
- 3) L.E. Flory (left), staff member, and Dr. V.K. Zworykin, vp and technical consultant of RCA Laboratories, demonstrating a new, simpler, compact and inexpensive TV camera for closed-circuit applications, 1949. Incorporating the Vidicon pickup tube, it was first demonstrated to the Institute of Radio Engineers on March 7, 1950.
- 4) RCA portable TV camera and transmitter, known as the "Walkie-Lookie," was developed in 1951 and used for the first time by NBC to cover the national political conventions in Chicago in 1952. The system weighed 53 pounds and had a range of about one mile.
- The RCA "TV Eye," incorporating the Vidicon tube, was produced at RCA Camden and introduced as a closed-circuit monitoring system for homes, schools and industrial facilities in 1953.
- 6) Early in 1956, the US Army Signal Corps unveiled an RCA-built "portable" television unit, consisting of an eight-pound camera and a 47-pound backpack transmitter with power supply, for use by soldier-scouts to send battle pictures to command posts.



RCA "TV Eye" gives schools a private TV network, takes talks and



In a railroad yard, RCA vidicon camera lets employees check car numbers at long range.



RCA vidicon camera in a bank, lett tellers verify the signatures on checks

Tireless TV Eye

New RCA TV camera an alert watchman for home, school, industry

Based on the vidicon tube, developed by RCA, a new instrument is on the way for homes, business, and schools—the RCA "TV Eye."

Light, compact, easy to use, "TV Eye" is a camera unit which can be connected to standard home receivers—makes any of the 23 million TV sets now in use a potential closed-circuit television system.

RCA's industrial version of the vidicon camera has already proved its place as an observer and guardian in science, industry, transportation, business—with new uses still being explored. Wherever distance or danger preclude a human observer's presence, the vidicon camera can take his place and stand watch.



"TV Eye" plugs easily into standard TV sets. You just switch to the selected channel, and see everything that the



* RADIO CORPORATION OF AMERICA

World leader in radio - first in television





- 1) RCA was a pioneer in research, engineering and testing of television in the UHF spectrum. The RCA "Tower of Success Hill" near Bridgeport, CT, was the first UHF station to operate on a regular daily basis, beginning December 30, 1950.
- 2) The "bow-tie" antenna, developed by RCA Camden engineers, proved its efficiency in receiving UHF television transmissions during the pioneering tests in 1950-52.

Pioneering in UHF: Operation Bridgeport (1949-1952)

Foreseeing the need to expand beyond the limited VHF spectrum for television broadcasting, RCA began investigating the use of Ultra-High Frequencies (UHF) as an alternative solution. A number of tests, under the direction of Dr. George H. Brown, were initiated in 1946. Operating from atop the Empire State Building, the initial tests were held to determine the types of tubes and transmitters needed for UHF broadcasting and reception. These tests were continued in Washington, DC in 1948. Results showed that an entire UHF station was needed to provide thorough tests.

In 1949, RCA selected a site in Stratford, Connecticut, 200 feet above sea level and two miles northeast of Bridgeport, to build its first UHF television transmitter station. The site was chosen since it was on the fringe reception area between New Haven and New York television stations, where co-channel interference was likely. The building was completed on November 15, with equipment supplied by the

Engineering Products Department of the Camden plant. On December 30, 1949, NBC began operation of this pioneering station, KC2XAK. It was the first and only UHF station in the country to operate on a regular, daily basis. NBC station WNBT, New York supplied the programs via microwave relays.

The RCA Victor Division designed and built 50 experimental UHF television receivers and 50 converters to permit standard sets to receive both VHF and UHF broadcasts. The RCA Service Company placed the sets and converters in homes throughout the hilly Bridgeport area for the tests. NBC also used a mobile (station wagon) receiving unit to randomly sample signal strength.

Tests were successfully conducted in 1950-51, proving that UHF television was a practical means of extending television service beyond the limited 12 channels in the VHF spectrum. The FCC visited the Bridgeport station to observe the tests, and over 60 manufacturers of television receivers used the facilities as a "proving ground" to design their own competing equipment. "Operation Bridgeport" concluded in August 1952, opening a new horizon for expansion of television into 70 new UHF channels.

Paralleling success in UHF, RCA-NBC jointly developed an improved method of reception in areas between stations operating on the same channel. Known as the "offset carrier" method, it eliminated the "venetian blind" effect of co-channel interference. RCA first demonstrated the technique in March 1949, which was subsequently employed in television stations throughout the country.



This "master key" opens television's doors

_ in millions of additional homes

Now the "green light" is official. Television can expand into UHF. Behind this decision are years of research and engineering, tested and proved at the first UHF station to operate on a regular daily basis— RCA's "Tower on Success Hill," near Bridgeport, Connecticut.

Bridgeport, Connecticut. Key to nationwide TV coverage, UHF provides 70 new channels for about 1500 new stations. Equally important, the ultra high frequencies can be utilized without diminishing service in today's 17 million television homes. More channels, more stations, mean more programs for present audiences—as well as television for the millions

Already, RCA has designed the equipment needed to broadcast UHF television, and is ready with instruments for home reception. This preparedness comes from more than 25 years of television pioneer ing, and represents an investment of approximately \$3,000,000 in UHF aloneincluding the vital studies at "Success Hill.

See the latest in radio, television, electronics at RCA Exhibition Hall, 36 Wes 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building Rodio Circ. N. New York 30 N. Y.



RADIO CORPORATION OF AMERICA
World leader in radio-first in television



NBC: First in Coast-to-Coast Television (1951)

With the completion of the AT&T transcontinental radio relay system in 1951, NBC's television network operations were extended from coast to coast. The first transcontinental telecast was the signing of the Japanese Peace Treaty in San Francisco on September 4, 1951.

The NBC network consisted of 65 stations by early 1952, five of which it owned and operated. As with radio, NBC continued as the industry pioneer in television broadcasting. The combined radio and television industry had grown to a \$5 billion business by 1952. Over 100 million radios and 18 million television sets were in homes across the United States by this time.

RCA and Color Television (1945-1955)

Research in color television, started before World War II, was resumed energetically by RCA in the post-war era of commercial television. As early as 1940, RCA Camden engineers had demonstrated a television receiver which produced color images by electronic and optical means to the FCC. NBC put the first color television pictures on the air by mechanical means in New York in 1941. These efforts were resumed upon the return to peace in 1945.

On December 13, 1945, RCA Laboratories demonstrated a mechanical color system in three dimensions at Princeton, NJ. This was followed by an October 30, 1946 demonstration of an all-electronic system, which produced color images on a 15 x 20-inch screen.

Demonstrations showing transmission through the air were held for the FCC at Princeton on January 29, 1947. On April 30, this same all-

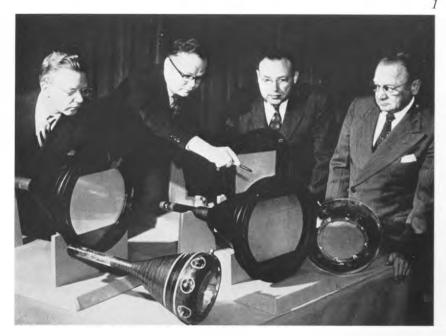
electronic color demonstration was given at the Franklin Institute in Philadelphia, where images were projected on a 7.5 x 10-foot theatre screen. Although still in a laboratory stage, the RCA system was well on its way to maturity.

On August 25, 1949, a new all-electronic, high definition, color television system, fully compatible with existing monochrome television, was announced by RCA to the FCC. On September 18, 1949, field tests began at NBC station WNBW, Washington, DC.

In 1949, the FCC scheduled a series of hearings to establish standards for color television. Under consideration were basically two competing systems. The first was the CBS noncompatible mechanical system, under development for 10 years, which was at a demonstrable stage. The second was the RCA compatible, allelectronic system, which was not yet ready for demonstration as a marketable product. As the hearings progressed through 1950, RCA engineers at Princeton, Harrison and Lancaster moved rapidly to develop the critical missing piece: a single, tube that would produce full color pictures. The result was the development of the tri-color picture tube, which RCA demonstrated to the FCC on March 23, 1950. On April 6, RCA demonstrated its color system for transmitting programs over coaxial cable networks.

Despite its rapid progress in developing an all-electronic, compatible system, RCA still lost the initial battle. The FCC approved the CBS non-compatible mechanical system on October 10, 1950. Despite an appeal by RCA, the Supreme Court upheld the FCC's decision on

- 1) RCA Scientists (l-r): E.W. Herold, E.W. Engstrom, H.B. Law and V.K. Zworykin, examining the five types of tri-color television picture tubes developed by 1950 for the RCA compatible, all-electronic color television system.
- 2) RCA's Dr. David Epstein with the tricolor television receiver projector he developed for large-screen theatres, circa 1950.







RCA wins fight for FCC decision benefits

compatible color television; public and television industry

RCA LEADERSHIP

The RCA COLOR TELEVISION SYSTEM operates on the

Color tellevision opens a new era in electronic communi-cations and adds a new dimension to the entertainment orts. It supplies a new power to advertising and greatly increases its metchandising possibilities. It adds realism to journalism, intensifies television as a social and educational force and opens the way for a significant advance in service to the public.

December 00, 1953, the day on which the FCC approved standards for the commercial broadcasting of COMPATIBLE COLOR TELEVISION. Will be remembered in the annols of communications along with the historic date of Api. 1939, when RCA-NBC introduced ALI-ELECTRONIC BLACK. AND-WHITE TELYISION on a new broadcast service by public at the opening of the World's Fair in New York.

At that time we added sight to sound. Now we add color

RCA is proud of the leadership its scientists and engineers achieved in developing—the all-electronic black-and-white relevision system—the all-electronic compatible color tele-vision system—and the RCA tri-color tube, which made the

Dedicated to pioneering and steadfast in our purpose to give America pre-eminence in communications, we shall confine our efforts to advance and to merit the faith and confidence the American people have in "ECA" as an emblem of quality, dependability and progress.



RCA-NBC

Deven years ago-on May 7, 1946-David Sarnoff, Chair-man of the Board of the Radio Corporation of America, said:

"When a modern and practical color television system or the home is here, RCA will have it."

The public will benefit

sion approved compatible standards for other television broad-casting. This is a great victory for BCA. Bird it is an even greater triumph for the public and the entire television industry. Color is a new dimension that will greatly be-fore a proposal control of the public and the second colors.

triumps for the public and the antire television industry. Color is a new dimension that util greatly increase the public and opposition of the wealth of new seems. Behind this great development are many long years of selection that great development are many long years of selection the great development are many long years of selection research and work and financial risk. Our selections was far search basically related to roder television as far should be the 1980-by. were before we introduced black—admishla dock as the 1980-w. even before we introduced black—admishla dock as the 1980-w.

back as the IEDVE... even neture we intrassume nucleonareaest identication services.

In the intervening years we have spent more than EES,000,000 to achieve our objective of adding the beauty and reality of color to the black-and-white service we pioneered.

The fruit of this great investment is the BCA all-electronic compatible color intervaling eyetem which makes it pearsible to send high quality color pictures that can be received in full color and high quality color pictures that can be received in full color with the contrast of the send high quality color pictures that can be set gen one sent. Without this ensemblishing, for which RCA has fought and contrast to firm the sent picture of the

RCA and NBC have the know-how to broadcast color pro-rams, to build equipment for color broadcasting, and to build

PIONEER A NEW ERA IN TELEVISION

sets that will receive these programs. In addition, we have trained personnel ready to do the job.

BCA and NBC will invest an additional \$15,000,000 during color television's introductory year to establish this new service on a solid foundation.

The industry will benefit

The industry will benefit

In the development of any great new service to the American
public, assesses must take the risks of leadership and incur the
initial capital expense required in start a new industry, RCA,
has done this before with radio large and the industry, RCA,
has done the before with radio pages with respective conpages and the industry as a service of the pages with respective conderivations. We spect \$50,000,000 in developing and establishing
black-and-white the television. From this pioneering, the public and
the industry as well as RCA have benefited.

In introducing color, RCA is following the same policy of
making its inventions available to the entire industry as it did
in radio broadcasting and black-and-white television. This
means that other members of this highly competitive industry
angel into color television goodly and benefit accordingly.

There are approximately \$5 competing set manufactures and
the competing to the manufacturers in the radio-television industry.

More than \$25 competing television stations now are on the
air. The opportunities to advance with noise television are available to
the one of them.

When will local relevision sets be available?

When will color television sets be available?

When will color television sets be available? Color television sets will bugin to come off the production lines in small quantities within approximately six months from today. It will probably be an additional year before man production is reached.

The first color sets manufactured by RCA will have a 14-inch picture size and will be priced between 5900 and \$1,000. Considering the relative values of the dollar, this compares favorship with the price of the first 10-inch black-and-white television sets introduced in 1839.

If you are planning to buy a television set, don't hesitate to buy now. For remember, the new RCA Victor television sets bring you sharper, clearer black-and-white pictures of every program on the air. ... whether they are transmitted in color or black and white.

When will color programs be available?

NBC has completed program plans for color television's intro ductory year that call for each of NBC's regular productions to be broadcast in color at issai most during the year—at the ave-age rate of two programs a week.

age rate of two programs a week.

RCA has completed plans for manufacturing transmitting and
studio equipment for broadcasting color. In accordance with our
policies, we are offering such equipment for sale to others.

Television stations throughout the country can make slight
modifications in their transmitting equipment that will enable
them to pick up from the network and broadcast these color
shows. Five NBC-owned stations and 68 NBC affiliated stations
already have announced their intention of doing so and störe
will follow.

stations the benefit of our experience in Interivining color.

BCA has formished competing manufactures with circuit diagrams and technical information which enable them to manufacture color reviewers and tri-color tables.

By the time manufacturers have produced color reactives for stations to transmit television programs in color.

BCA, the pioneer in compatible color statestion development, and NBC, the phoneer in color television breadcasting and programming, are proud to have the opportunity to bring a new service to the American public. The the reportunity to market the lives of people everywhere is a privilege of isadership.

Frankon Falson

RADIO CORPORATION OF AMERICA

May 28, 1951 and authorized color television

broadcasting to begin June 25.

The National Television Standards Committee (NTSC), formed in January 1950, did not play a major role in the hearings. However, following the FCC decision in favor of CBS, the NTSC became more active. On November 20, 1950, it set up a subcommittee to investigate an alternative compatible color television standard. D.B. Smith of Philco chaired the subcommittee, which included members from Dumont, Hazeltine, GE and RCA. The subcommittee issued its first report in early 1951, recommending a system which incorporated many essential features of the RCA system. The report, however, did not give RCA full credit. Hazeltine, in fact, was responsible for suggesting improvements to the RCA system, which the latter acted upon.

The subcommittee report was approved by the NTSC, which then set up 11 panels containing representatives from 29 companies to oversee a series of field tests. These tests were conducted throughout 1952, and numerous improvements were made.

On July 21, 1953, the NTSC approved the all-electronic, compatible system submitted in a revised report from the 11 panels. It began petitioning the FCC to reconsider its decision.

Following a successful demonstration, the NTSC system was approved by the FCC on December 17, 1953.

RCA broadcast equipment for color broadcasting was rapidly developed for television stations. The first commercial studio color camera, employing three Image Orthicon tubes, was the TK-40. Built at the Camden plant, it weighed 300 pounds. The TK-41 superceded the TK-40 in 1954. Designed for either studio or field use, the TK-41 was easier to operate and maintain.

A color camera, designed specifically for use in the medical field, was developed in 1953. Titled the TK-45, it was first used on January 19, 1955. Designed for closed-circuit use, the TK-45 used three Vidicon tubes.

The Engineering Products Department at Camden also designed and manufactured color television transmitters, monitors and antennas. The first RCA magnetic tape recording system for both monochrome and color television programs was developed and demonstrated in 1953.

On January 1, 1954, NBC made the first national network color broadcast. The Tournament of Roses Parade in Pasadena, California was viewed by audiences across the nation. NBC began expanding color television facilities on

1) This RCA advertisement, prepared in anticipation of a favorable FCC decision to select the corporation's compatible color system over the previously-approved non-compatible CBS system, was run in major newspapers

across the country on

December 20, 1953.

FACTS

the American People Should Know About

COLOR TELEVISION

THE FEDERAL COMMUNICATIONS COMMISSION is to be congratulated for approving the National Television System Committee standards for color television. These standards will give the American public the finest black and white and color television service in the world.

These standards were developed by the leading scientists of the electronics industry. They are NOT the work of ANY ONE COMPANY. In the words of the Federal Communications Commission: "The accomplishment of a compatible color television system that can operate within a 6 megacycle bandwidth is a tribute to the skill and ingenuity of the electronics industry."

nes of some of the organizations whose combined knowledge and strength are responsible (or the system that won final F.C.C. ap

Admiral - American Broadcasting Company - American Radio Relay League - Arvin - Bell Telephone Laboratories - Bendix Capehart - Farnsworth - Chramatic Television Laboratories - Color Television Inc. - Calumbia Broadcasting System - Crosley - DuMoni DuPont - Eastman Kodak - Emerson - Federal - Freed - Garad - Gates - General Electric - General Aniline - Hallicrofters Hazeltine - Magnavax - Mallory - Matorola - Philos - Pilot - Raytheon - RCA - Remington-Rand - Scott - Sentinel - Stewart-Warner Stromberg-Carlson - Sylvania - Technicolor - Tele-King - Warwick - Wells Gardner - Westinghouse - Zenith

panies to develop a compatible color system were turned down by the Commission as technically inadequate, the industry as a whole formed the management the industry as whose states the sug-gestion of the Chairman of the F.C.C. Their objective was to develop the standards for an all-electronic system which would meet the requirements of the

dreds of scientists of the electronic industry combined their efforts, developed one set of standards ofter another, all of which were subjected to rigorous seld tests until the major problems were overcome and the final result achieved . . . the color system which the industry committee recommended to the Commission with confidence in July, 1953. This is the system the F.C.C. has now adopted and made official. Every electronic laboratory, every television manufacture, large or small, who participated in this gigantic undertaking can rightfully share in the credit for the final result. It is a thrilling story of the cooperative strength of American industry in the solution of a highly-compler peace-time problem. By developing these standards, the industry has protected the public sinvestment in the seven billion dollars of television sets now in use, since you will

eceive all future color programs in black and white in your present set wit out adding one cent of addi-

You should understand that much work still available in quantity for a long time. Now that the they can afford to pay, $\Delta x_0 = 1$ developed only small acreen color tubes with approximately 11°, inch viewing screens giving only 88 square inches of picture, which will cost from 5800 to 51000 each. Contract this with body's 11 line black and white set with an approximate 250 square inch picture which sells for an little as \$500.

This information is being published so that the public may be more fully and more accurately in formad. We believe that the American people, who empty the world's highest standard of living, are interested in the fact that the entire electronic industry joined hands to bring them also the highest standards of color and black and white television in the world.

PHILCO CORPORATION

PHILADELPHIA, PA.

2 3



both the east and west coasts. Thirty-one stations were equipped for colorcasting by March 1954. On December 31, 1954, NBC opened a \$3.5 million color studio in Brooklyn, NY. The first studio built from the ground up for color television was NBC's "Color City" at Burbank, California. The \$7 million project was completed on March 27, 1955.

A total of 68 hours of colorcasts were made by NBC in 1954, versus 46 hours by CBS and none by ABC. In May 1955, NBC transmitted the first color television programs on tape. NBC's colorcasts in 1955 totaled 215 hours.

Commercial production of RCA color television receivers started at the Bloomington, IN plant on a limited basis on March 17, 1954. The first RCA model, the CT-100, had a 12-inch screen and a suggested retail price of \$1000. The first 21-inch color picture tube was shown to the public on September 15-16, 1954, during a symposium at RCA Laboratories in Princeton, NJ. It was demonstrated on December 6, 1954 and introduced in two new receivers in January 1955, priced at \$895 and \$995. In December 1955, RCA offered the first complete line of color television receivers, ranging in price from \$695 to

RCA manufacturing facilities for television receivers were expanded in 1954 with the addition of a plant at Findlay, OH. This plant was responsible for production of various components and subassemblies, including yokes and transformers. The RCA Bloomington plant was completely converted to manufacture color receivers in 1956 and RCA expanded its product line to include a \$495 set with a 21-inch tube. Blueprints and manufacturing instructions for RCA's color television receivers were offered to the company's licensed competitors in 1956.

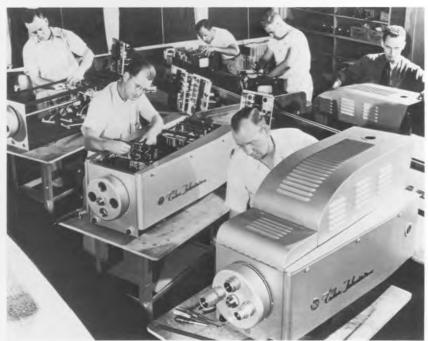
- 2) Philco Corporation's response to RCA's December 20, 1953 announcement of its color television victory in The Philadelphia Inquirer, reminding the American public that other companies, including GE, were key contributors in developing the NTSC standards for color television. This ad was run on December 27, 1953. Courtesy: Dan Tannenbaum.
- 3) To increase the supply of component parts for television receivers being manufactured at the Bloomington and Indianapolis, IN plants, RCA built a plant at Findlay, OH in 1954.





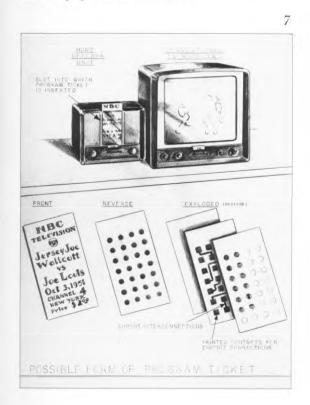


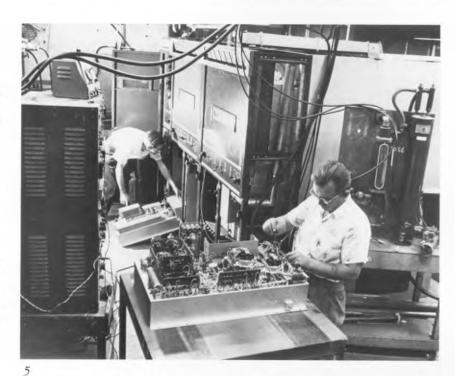
- 1) The first RCA commercial studio color camera, the TK-40, circa 1952.
- 2) The first regular TV broadcast in color, locally originated by WKY-TV Oklahoma City and via network by NBC-TV, used RCA's pioneering TK-41 color studio camera.





- 3) Production of the RCA TK-41 color television camera, Building #10, Camden plant, December 17, 1953, for sale to broadcasting stations across the country which were preparing for the introduction of color TV as a new service to the public. In the rear row (l-r), Joe Postick, William Haines and Bob Morford assembled viewfinders, while in the foreground (l-r) Harvey Nichols, M. Anderson and George Sink assembled the cameras.
- 4) RCA Victor introduced television for scientific applications in 1947, when televised pictures of surgical operations were transmitted for the first time from a New York hospital to members of the American College of Surgeons at the Waldorf-Astoria hotel. This photo depicts the TK-45 color television camera, produced exclusively for medical science use, in 1953. Courtesy: Felix Cone.
- 5) Six-kilowatt color television broadcast transmitter, manufactured at RCA Camden, 1954.
- 6) Soldering components onto a deflection chassis for the TM-21 color television monitor at RCA Camden, 1954. The TM-21 was manufactured for studio use by television broadcast stations.
- 7) Perhaps the first concept for "pay-per-view" television from the home, as sketched by an engineer at RCA Camden in 1953. An idea ahead of its time, the project never materialized.







RCAVICTOR

first in black-and-white television first in compatible color television

invites you to see and order

COLOR TV

at its brightest and best



Every year more people buy RCAVICTOR than any other television

- 1) The RCA Victor CT-100, first compatible color television set, was introduced to the American public in 1954. This advertisement appeared in The Philadelphia Inquirer on May 16, 1954. Courtesy: Dan Tannenbaum.
- 2) Manufactured at the Bloomington, IN plant, the CT-100 sold for an incredible price of \$1000.
- 3) NBC mobile television units, equipped for color broadcasting, were produced by RCA EPD, Camden, beginning in 1954.







RCA'S BRILLIANT "21"

One day color television will reach virtually every farm-house, city and suburban home in America. Compatible color television, pioneered and developed by RCA, is on the march with RCA's big new 21-inch color tube—and its 255 square inches of viewing area.

Dependable in performance, spectacular in quality, this new tube in conjunction with the RCA magnetic equalizer blends the colors evenly to the extreme edges of the picture.

The scientific and engineering advances in this tube are

typical of every product under the trademark "RCA" world-wide symbol of quality, dependability, progress.

In the David Sarnoff Research Center at Princeton, New Jersey, in the RCA Victor manufacturing plants, in the NBC broadcasting stations, as well as in RCA's world-wide radiotelegraph stations, there are 70,000 members of the RCA Family. As one of America's foremost industrial teams they work to advance radio, television and electronics for civilian and industrial uses as well as for national defense.



RADIO CORPORATION OF AMERICA

ELECTRONICS FOR LIVING

RCA Victor Division: Organization and Expansion (1945-1949)

The story of the RCA Victor Division, the largest division of RCA, in the post-war years is one of tremendous growth and achievement. What began as a centralized manufacturing hub in Camden, NJ for RCA products in the early 1930's, grew to become an organization with eight manufacturing plants in five states by 1946. This phenomenal growth was largely due to increased production demand during the war. The RCA Victor Division had quite an impressive record by war's end. Between 1930 and 1944, RCA Victor had produced: 21,700,000 radio and phonograph sets, 452,000,000 tubes (the largest manufacturer in the US), 325 of the 900 broadcast stations transmitters in the US (the largest manufacturer in the US), 25 of the 91 transmitters for broadcast stations in Canada, 2,000 sound systems for industrial plants, and 6,000 sound reproduction systems for theatres.

The incredibly large and diversified product line of RCA Victor in 1945 was unmatched in the communications-electronics industry. With headquarters in Camden, the RCA Victor Division consisted of five product groups in 1946: 1) Radio, Phonograph and Television (Home Instruments) Department, (Camden, Indianapolis, Bloomington, Chicago, Monticello and Pulaski, Virginia plants all contributing); 2) Record Department (Camden, Indianapolis, New York, Hollywood); 3) Engineering Products Department (Camden); 4) Industrial and Sound Department (Camden, Hollywood); and 5) Tube and Equipment Department (Harrison, Camden, Lancaster, Indianapolis). All were supported by the RCA Service Company, Inc.

The post-war era saw explosive manufacturing growth at RCA in both commercial and government programs. By 1949, new plants were added at Marion, Indiana (television tubes); Canonsburg, Pennsylvania (records) and Detroit, Michigan (Brenkert film projectors).

Organizational realignment was necessary to manage this ever-growing business. In 1949, the Engineering Products and Tube Departments were combined to form the Technical Products Division under L.W. Teegarden. The Home Instruments (formerly Radio, Phonograph and Television) and Record Departments were combined with the RCA Victor Distributing Corporation to form the Consumer Products Division under J.B. Elliott. The functional departments of Accounting, Budget, Distribution, Engineering, Finance, Law, Personnel,

Materials, Public Relations and Plant Engineering were all placed under W.A. Buck. The RCA Service Company, Inc., headed by E.C. Cahill, was the fourth business. All four reported to J.G. Wilson, executive vice-president, RCA Victor Division.

RCA Victor Records and Home Instruments (1945-1954)

Resuming peacetime operations, "His Master's Voice" resounded once again from the laboratories and production lines of RCA Victor. The Camden headquarters, as well as Indianapolis, Bloomington and Monticello, IN resumed production of home instruments for the consumer market. In addition to Monticello, a second cabinet manufacturing plant was started at Pulaski, VA. Portable radios, high-fidelity phonographs and television sets were manufactured in increasing numbers to meet the demands of a hungry American public. Sound recording activities at RCA studios in New York, Chicago, and Hollywood were refocused from supporting the war to supplying new music to the consumer. Record presses at the Camden, Indianapolis and Hollywood plants started up again. RCA Victor was ready to entertain an eagerly awaiting America.

- 1) Frank M. Folsom, vice-president in charge of the RCA Victor Division, holding the one billionth RCA Victor record at a ceremony marking this phenomenal achievement in Building #10 of the Camden plant, 1946.
- 2) Post-war message from RCA President and Chairman of the Board David Sarnoff on radio and television as media to spread peace in the world, 1948.





Freedom to LISTEN - Freedom to LOOK

As the world grows smaller, the question of international communications and world understanding grows larger. The most important phase of this problem is Freedom to Listen and Freedom to Look—for all peoples of the world.

Radio, by its very nature, is a medium of mass communication; it is a surrier of intelligence. It delivers ideas with an impact that is powerful - . . Its essence is freedom—liberty of thought and of sreech.

Radio should make a prisoner of no man and t should make no man its slave. No one should

2

brain from listening. Always and everywhere, it should be the prerogative of every listener to turn his receiver on or off, of his own free will.

The principle of Freedom to Listen should be established for all peoples without restriction in fear. This is as important as Freedom in Speech and Freedom of the Press.

Television is on the way and moving steadily forward. Television free the innegination, and the day is foreseen when we shall look around the earth from city to city, and nation to nation, as easily as we now listen to global brankeasts. Therefore, Freedom to Look is as immortant as

Freedom to Listen, for the combination of these will be the radio of the future.

The "Voice of Peace" must speak around this planet and be heard by all people everywhere, no matter what their race, or creed, or political



*Excerpts from an address before the United States National Commission for UNESCO.



RADIO CORPORATION of AMERICA

FREEDOM IS EVERYBODY'S BUSINESS





4

The post-war era at RCA Victor was highlighted by significant advances in both records and home instruments. On August 30, 1945, after eleven years of research, RCA introduced the first non-breakable, high-fidelity records. These new disks were stamped with a new label, beginning January 1, 1946. "RCA Victor," replaced the "Victor" and "Bluebird" labels. Nipper, of course, remained.

On January 11, 1949, a revolutionary new system for reproduction of recorded music was introduced by RCA to the world. Designed and developed at Camden, it was based on an unbreakable vinylite record, 6 7/8 inches in diameter, and a fast-changing record player, operating at 45 rpm. The system, introduced in response to rival Columbia's 1948 release of 33 1/3 rpm long-playing records, was an immediate hit. Over 25 million RCA 45-rpm records were manufactured in 1949 alone. Output doubled in 1950.

Record pressing operations had ceased at the Camden plant in December 1948. Besides Indianapolis and Hollywood, plants at Canonsburg, Pennsylvania were added for record pressing (1949) and portable radio manufacturing (1947).

In 1950, RCA Victor unveiled a new phonograph which played records at all three speeds—33 1/3, 45 and 78 rpm. RCA Victor 33 1/3 rpm records were also introduced in March 1950. On July 31, 1952, a new, longer playing 45 rpm record, called the "Extended Play," or "EP," was released by RCA Victor. Utilizing a greater playing surface, the EP provided up to eight minutes per side.

To satisfy increasing demand for highfidelity instruments, a plant at Cambridge OH was acquired in 1953. With 15 assembly lines running eight hours a day, daily output averaged 6000 sets. At that time, the Cambridge plant was the world's largest producer of packaged hi-fi instruments.

- 3) Among RCA's numerous contributions in high-fidelity music for home entertainment was the LC1A duo-cone speaker. Developed in 1947 at RCA Laboratories, this first two-way, 15-inch speaker was placed in production one year later.
- 4) By 1950, the RCA Victor Division had established two new plants in Canonsburg, PA. One was for record manufacturing; the other for portable radios.







1) On January 11, 1949, the RCA Victor Division announced a new system for the reproduction of recorded music in the home that would revolutionize the record industry: the 45 rpm vinylite record and fast-changing record player. RCA sold over 75 million of these 6 7/8-inch diameter disks in just the first two years.

- 2) The "45 EP" Extended Play record, introduced by RCA Victor on July 31, 1952, provided up to 16 minutes of music per disk.
- 3) The RCA Victor plant at Cambridge, OH, acquired in 1953, was the world's largest producer of packaged hi-fi instruments at the time. Fifteen assembly lines, running for eight hours, turned out 6,000 sets. The plant was converted to defense electronics manufacturing in 1961.



- 4) The "Treasure Vault," home to the priceless collection of all Victor master recordings dating back to 1898, was located in the basement of Building #11 of the RCA Camden plant and guarded 24 hours a day in 1953.
- 5) The RCA push-button tape recorder provided a new form of entertainment for American families in 1953. In addition to recording their favorite radio programs, Americans could conveniently record their own audio memories.



You're funnier than Berle... better than Pinza!

Make your dabut on the new

A push of a latters—and you're out.
The new RCA Tape Reposites prives it yours is without question the greatest theatrical family of all time. Will, latter than the Talliota.

ment short, surpray.

There are smutches times of enterhalment and years of position numeries halff into this electronic stunders that the position tape recorder study. And it has to punitual side, too. is can hape your favorite rullion of the extension of the

igot.

But mainly this remarks remarks will be the usual and voice of rour family. Firthday parties, brilday patherings meddings—captured for

The BCA sublem is your assurance of perfect tonal clarity, of top operational ease, and of meny, many years

Another minima accomplished in BCA's survey-ending program of bringing the very lend in sound and entertainment into the home. First the BCA Victor planningsph. then BCA Victor actio, and BCA

First the BCA Victor plannagraph, them RCA Victor redin, and BCA Victor television. Today the new BCA Posh-Button Tape Recorder. And there are many insurence usus in the BCA "mirkshop," tool.



RADIO CORPORATION OF AMERICA

World leader in radio-first in television





5



6) Expanding its record manufacturing operations further in 1954, RCA Victor built a new plant at Rockaway NJ.





- 1) In 1954, a new headquarters for RCA Service Company, Inc. and RCA Victor Home Instruments Division was built in Cherry Hill, NJ. This photo shows the site on April 4, 1954. Courtesy: GE Government Services.
- 2) The RCA Cherry Hill, NJ plant construction site on July 13, 1954. Courtesy: GE Government Services.
- 3) Concurrent with the completion of the RCA Victor Home Instruments Division facility at Cherry Hill, NJ, a new exhibit was opened on the history of the Victor Talking Machine Company and RCA. Called the RCA Hall of Progress, the exhibit was open to the public on a daily basis free of charge. James M. Toney (left), general manager of the RCA Victor Radio and Victrola Division, was interviewed by NBC reporter Dick McCutchen during a special network telecast on the Today show on July 13, 1955. Courtesy: GE Government Services.
- 4) RCA recording star Lena Horne, enjoying the RCA Victor Mark I hi-fi set at the Hall of Progress, Cherry Hill, NJ with J.M. Toney, general manager, July 13, 1955. Courtesy: GE Government Services.







The RCA Victor Division achieved a major milestone in television in February 1950, when it produced its 1 millionth black-and-white receiver. Television set manufacturing at the Camden plant (Building #3) ended by 1952, due to the need for additional space to accommodate the growing defense electronics business. The Home Instruments Department, located in Buildings #5, 6 and 7, Camden, was relocated to Cherry Hill, NJ in 1954. The newly-completed Cherry Hill plant became the new headquarters for the RCA Service Company as well, which was also moved from Camden in 1954.

In June 1954, the RCA Victor Division released the industry's first pre-recorded tapes to the consumer market. The one-quarter-inch, conventional magnetic tapes were dual-track, in a reel-to-reel format.

Still requiring additional space for record manufacturing, another plant was constructed at Rockaway, New Jersey in 1954.

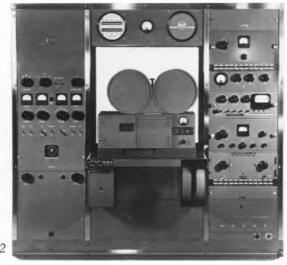
In addition to home instruments and records, RCA Victor ventured into a new consumer product line in 1952: home appliances. A line of air conditioners and dehumidifiers were introduced that year. In November 1952, RCA Victor entered the gas and electric range business, as well as the gas and oil space heater field, with the acquisition from the Noma Electric Corporation of its Estate Stove Division at Hamilton, Ohio. A new line of ranges and heaters, under the brand name "RCA Estate," was introduced in January 1953.

The post-war growth of the RCA Victor Home Instruments and Record Departments, as well as the addition of the RCA Home Appliances Department, dictated a need for organizational realignment by 1954. As part of a major corporate-wide reorganization, these three departments were upgraded to division status and combined under a single executive vice-president, J.B. Elliott, as RCA Consumer Products in May 1954.

5) Following a tour of the RCA Hall of Progress at the Cherry Hill, NJ facility, vocalist Vaughn Monroe takes Miss New Jersey (Patricia Campbell of Camden) for a ride around the new facility, July 13, 1955. Courtesy: GE Government Services.

- 1) The RCA Victor 16-mm sound film projector model PG-201, produced by the Engineering Products Department (EPD), Camden, NJ, was a popular audio-visual aid for industrial sales presentations in 1947.
- 2) Custom-built theatre sound system produced by RCA EPD, Camden, April 1947.
- 3) RCA in-car speakers for drive-in movie theatres were part of a complete line of theatre equipment produced by the Engineering Products Department, Camden in 1946.
- 4) RCA 16-mm television projectors built by EPD, Camden, for broadcasting motion pictures, April 1947.





Engineering Products Department (1945-1954)

As manufacturing activities at the Camden plant shifted from consumer products to communications-electronics for defense during World War II, the Home Instruments Department was displaced by the Engineering Products Department (EPD) as the main business group of RCA Camden. Defense electronics, ranging from battle announce equipment to airborne radar, were produced by EPD during the war. By 1945, EPD had developed a large and diversified product line for both commercial and defense applications in post-war America.

In the post-war era, EPD had become a thriving business. The organization had grown significantly by 1951, requiring every available square foot of space at the Camden plant for its engineering and manufacturing activities. Broadcast equipment was produced for the booming television industry. With the advent of the Korean Conflict, defense electronics development and production increased significantly.

Under Chief Engineer Max Batsel, EPD's Engineering Division was developing new and innovative devices for both commercial and government customers. The division consisted of two major product engineering groups; one for customer devices, the other for standard products.

Standard Products Engineering, led by V.E. Trouant in 1951, had five sections. The Communications and Sound Section, managed by N.M. Brooks, developed sound systems for theatres, mobile communications, microwave relay equipment and measurement and test devices. Work was conducted in Buildings #10-5, 10-4, 13-5 and 13-4 of the Camden plant.

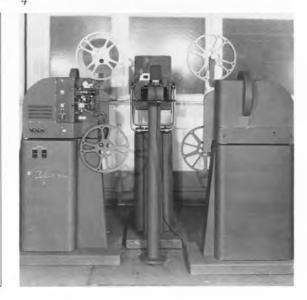






with RCA

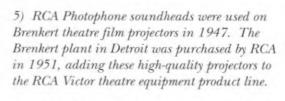




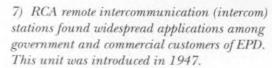




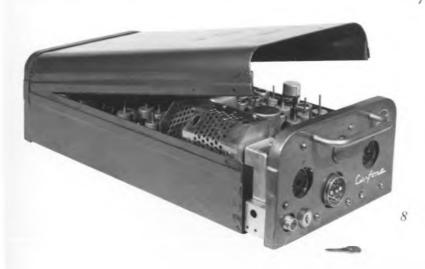




6) In 1951, the RCA Victor Division purchased this plant in Detroit, MI from the Brenkert Light Projection Company, adding new 16-mm and 35-mm projectors to its existing product line. The Detroit plant also produced equipment in support of the Camden-based Engineering Products Department (EPD).



8) The Carfone 150, introduced by RCA Camden in 1954, was a two-way, VHF-FM mobile communications system. This transmitterreceiver, operating on either a 6V or 12V battery, was a predecessor to present-day car phones.



-

The Industrial Products Section of RCA EPD, Camden, under J.E. Eiselein, developed scientific instruments (electron microscopes, etc.), metal detectors, industrial television equipment, crystals for radio-frequency devices, beverage inspection machines and radio-frequency heating devices. The work was conducted in Buildings #10-5, 10-4, 6-4 and 53.

RCA metal detectors were designed for industrial use to insure products being free of contaminating metals and to protect equipment which could be damaged by the presence of metal.

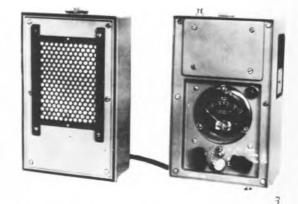
Another product line of the Industrial Products Section was detectors for alpha, beta and gamma radiations from radioactive materials. Started in 1947, various portable devices were produced for the US Government.

RCA automatic beverage inspection machines were added to Camden's diversified product line in 1941. Designed for use by bottlers of soft drinks and beer, these machines automatically inspected filled bottles as they passed along a conveyor and rejected those which contained any foreign particles. Up to 145 bottles per minute could be inspected by these systems.

A pioneer in radio-frequency heating (radiothermics), RCA EPD developed equipment to speed industrial manufacturing processes in many new post-war fields. Applications included plastic molding, drying synthetic yarns, seaming thermoplastic materials and laminating woods.

A third section of RCA EPD's Standard Products Engineering in 1951 was the Broadcast





- 2) On December 9. 1946, a milestone in the application of electronics to scientific research was reached when the 200th RCA electron microscope was completed at the Camden plant. T.A. Smith (left) of RCA EPD and Dr. P.E. Klopsteg, director of research at the Technological Institute, Northwestern University, were pictured here with the instrument, which Klopsteg formally accepted on behalf of Northwestern.
- 3) This portable alpha particle detector, the AN/PDR-11, was a battery-operated unit built in 1952 at RCA Camden.
- 4) RCA beverage inspection machines, for inspection of bottled soft drinks and beer, were manufactured in Building #17-6, Camden, beginning in 1941.



1) A table model electron microscope, the EMT, was introduced by RCA Camden in 1950. It was the first to use permanent magnetic lenses successfully, assuring lens stability.





Studio Equipment Section. Managed by W.J. Poch, this group developed broadcast audio, television studio and relay equipment. Operations were located in Buildings #10-5 and 7-2.

The Broadcast Transmitter Equipment Section, under J.E. Young, developed transmitters and antennas for AM, FM, and television broadcasting and special purpose transmitters for the US Government. All work was done in Building #53, State Street and River Road, Camden, NJ.

The fifth section of RCA EPD's Standard Products Engineering, headquartered in Hollywood under A.C. Blaney, was the Film Recording Section. By 1951, most of RCA's Photophone equipment was produced at the Hollywood plant.





- 6
- 5) The TM-5A Master Monitor, designed and built at RCA Camden in March 1947, was used for offline monitoring of studio and field TV cameras.
- 6) RCA portable amplifier model OP-6, introduced by EPD, Camden in 1948.
- 7) The BK-4A "Starmaker," a compact highfidelity, unobtrusive ribbon-pressure type microphone for use in radio and television studios, was developed at RCA Camden and announced to the industry on September 15, 1950.
- 8) C.A. Rosencrans (left), project engineer, and J.L. Lovvorn of the Camera Equipment Group, EPD, Camden, with microwave relay equipment used for studio to transmitter links (STL), 1952.





1) The Advanced Development Section of the Camera Equipment Group, RCA EPD, Camden, NJ in 1952 (l-r): Dr. H.N. Kozanowski (supervisor), E.M. Gore, R.J. Marion and B.F. Melchionni. They were pictured here with an Iconoscope tube and a film camera which produced improved-quality movies for televison broadcast.

2) Members of the Terminal Equipment Group, Broadcast Studio Engineering Section, RCA EPD, Camden, with their redesigned television master monitor, 1952 (l-r): P.C. Harrison, S.L. Bendell, N.P. Kellaway, N.J. Oman, A.J. Banks, and C.P. Corey.



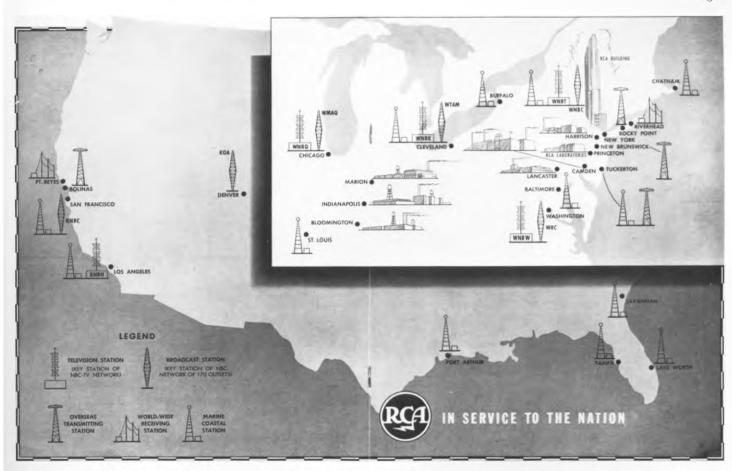
3) With the advent of the Korean Conflict, the Terminal Equipment Group refocused its efforts on many US Government programs. Among the key players in 1952 were (l-r): J.L. Grever, J.P. Ulasewicz, B.C. King, D.E. Warfield, H.C. Shepard, A.C. Luther and A.H. Lind, supervisor.



- 4) Officers of the USS Courier, inspecting a portion of the 150-kilowatt transmitter designed and built by RCA Camden for the Voice of America's floating broadcaster, 1952.
- 5) Five-kilowatt transmitters for AM radio broadcasting being assembled at RCA Camden, circa 1950.



5



6) Continental US locations of RCA's overseas transmitting and receiving stations, marine coastal stations, manufacturing plants and NBC's television and broadcast stations, as of 1949.

1) Construction of the main building of the new RCA engineering plant in Moorestown, NJ began in spring 1952 on a 28-acre site in the midst of an asparagus field. Of the remaining 392 acres of the tract, 33 acres were planned for testing special apparatus, and 10 acres were for an antenna site. Courtesy: Joe Beezer.

2) The Moorestown plant construction site in January 1953, showing the framework for the engineering and laboratory building on the left and the completed production and model shop buildings on the right. Courtesy: Joe Beezer.

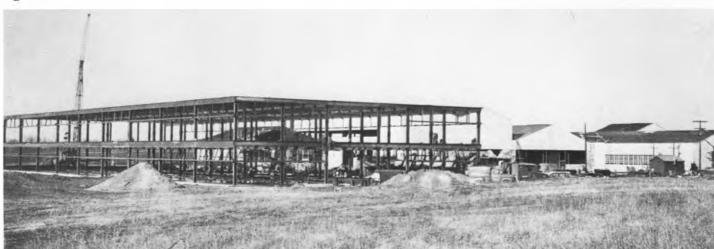
Custom Products Engineering was the other main group of RCA EPD's Engineering Division. Led by R.C. Willman in 1951, this group consisted of four sections. The majority of the work was for the US Government.

The Radar Section, managed by H.R. Wege, developed ground-based and sea-based radar receivers, indicators, transmitters and antennas. This was a growing business at RCA Camden, and facilities at Buildings #53A, 10 and 17 soon proved inadequate. Construction of a new engineering plant on a 420-acre tract in Moorestown, NJ began in the spring of 1952, and assembly operations commenced November 1, 1952. The production and model shops were completed by January 1953, and the engineering building was finished by November. Dedication ceremonies were held on December 5, 1953.

More than 8,000 people were on hand to join RCA officials and leading members of the Moorestown Community in dedicating the new engineering and production plant. W. Walter Watts, vice-president of RCA in charge of techical products, delivered the dedication address. Members of the community were welcomed by William Hall, chairman of the Moorestown Township Committee. The flag was presented by L.W. Teegarden, executive vice-president of RCA, and was raised by electronic means when Mr. Teegarden pressed a button on a miniature transistorized transmitter. Theodore A. Smith, vice-president in charge of RCA Engineering Products Department, served as master of ceremonies. Other speakers were Harry R. Wege, engineering manager of the new plant; Joseph S. Beezer, new plant manager; and John A. Kelly, personnel manager.

The plant was officially opened when Charles M. Odorizzi, operating vice-president of RCA Victor Division, pressed a button that set off a small capsule of explosive powder, parting the ribbon stretched across the entrance. An elaborate open house celebration followed the dedication ceremonies.













- 3) Main Street, Moorestown, NJ in 1953. This historic town was an ideal location for the new RCA radar plant. Adjacent to the New Jersey Turnpike, rapid access was made possible to RCA Laboratories in Princeton. The site was also located about halfway between RCA's tube development centers at Harrison, NJ and Lancaster PA.
- 4) Moorestown extended a warm welcome to its new neighbors in the RCA engineering plant. A bond had already been established between this friendly community and RCA Victor years before, through the founder of the Victor Talking Machine Company, Eldridge R. Johnson. Johnson's generosity was evidenced by his funding of the handsome Moorestown Community House, which was made available to RCA plant personnel for social and recreational activities in 1953.



5) Among those gathered around the flagpole for the official dedication ceremonies of the Moorestown plant, December 5, 1953, were Joseph S. Beezer (left of flag), new plant manager; Theodore A. Smith (second to right of flag), vice-president, EPD; and Harry R. Wege (fourth to right of flag), new plant engineering manager.



6) The first product shipment from the new RCA Moorestown plant in 1953 was a submarine radar display unit. On hand for the event were (l-r): Ted Smith, vice-president in charge of EPD, Camden; Max Batsel, chief engineer, EPD, Camden; Joe Beezer, Moorestown plant manager; the accepting resident US Navy inspector; Tom Massoth, comptroller, EPD; and Art Malcarney, general plant manager, EPD, Camden. Courtesy: Joe Beezer.







The Aviation Section of RCA EPD, Camden, under J.D. Woodward, designed, produced and tested communications transmitters and receivers for aircraft, airborne radar, and navigational aids. Like the Radar Section, the Aviation Section was a growing business. Operations in Building #13-7 became spacelimited. To accommodate growth in airborne radar, additional manufacturing space was provided in Building #3 in 1951. The area was made available by transferring the Home Instruments Department's television receiver manufacturing operation to Indianapolis that year. A new plant was also added in Los Angeles, CA in 1951, increasing airborne radar production by 80 percent. The rapid growth of RCA's aviation communications and radar businesses required extensive flight testing programs. In 1955, a new RCA flight test laboratory was established at the New Castle County Airport, DE for equipment testing on a number of USAF aircraft. A hangar was constructed by Atlantic Aviation, which served as lab headquarters. Among the aircraft used for the tests were B-25, C-47, C119, Cessna 310 and an RCA-owned T-11.

- 1) This USAF B-25 was one of the aircraft used by RCA for testing airborne electronic equipment at New Castle County Airport, Delaware, where a new flight laboratory was established by the company in 1955.
- 2) RCA aviation equipment engineers standing before the USAF B-25 used to test radar and communications equipment produced by EPD, Camden. The tests were held at New Castle County Airport, Delaware, beginning in 1954.
- 3) An RCA aviation equipment engineer installing radar equipment in the cockpit of a B-25 at New Castle County Airport, Delaware for flight testing, 1954.
- 4) RCA aviation receiver model AVR-22, manufactured in Building #13-7, EPD, Camden, April 1947.
- 5) Airborne High-Frequency (HF) communications equipment for long-range military missions was another major product line begun by RCA EPD during World War II. Continuing post-war development led to the AN/ARC-65 single sideband receiver-transmitter, which became standard equipment in USAF aircraft for many years.







Teleran-"radio eyes" for blind flying!

It's a televiator "information phone" between airplane and apport -ovite tire prior's sportions given split neural accovery on a tuleviane screen prounted to the rockpti. Televian of contraction of TELEVIANO.

Teleran is exercution of TELE-vanon— Radae Air Navigation) collects all of the necessary information on the ground by radar, and their instantly transmits a test-"asso picture of the assembled data to the olds aloft in the airdine."

On his receiver the pilot sees a picture thowing the position of his arplaine and the position of all other sterralt near his altirude, superimposed upon a terrain map samplete with route markings, weather conditions and ununtable visual neutro-

tion. The complex problem of an traffic control is well bandled by Teleran.

Televise-mother a biosymmic of DCAtic baring dissibility of with Televise and Foundation recognition by BCA Laboratorium and BCA. Victor, endings insures at Matary making developments in reads and electronic. They are also your assurance that gray product bearing the BCA or BCA. Virus interaction is now of the finest instruments of it is kind science has yet achieved.

Radio Corporation of America, RCA Building Radio City, New York 20 . Listen to The RCA Visco Street, Sandays, 200 F. M. Fast or Standard Time, over the NIE Society



Instrument Famil of the Future The Toleran indeator, mounts to a cockpit, simplifies the pilot of he showing his position relative to the sirport and toothes planes the second of the second metal disselling mount of the most metal disselling mounts in the history of accustom

RADIO CORPORATION of AMERICA



RADIO CORPORATION of AMERICA

RCA, basic dasigner of all sir-borns LORAN equipment used in the contract of t

provided "eyes" to pilots by collecting information on the ground by radar and instantly transmitting a television picture of the assembled data on a screen in the cockpit. 7) Well proven during the war as an accurate long-range navigation aid, the RCA AVR-26 Long-Range Navigation (LORAN) system was introduced successfully to the commercial aviation industry in 1946. The 35-pound units were initially produced by EPD, Camden, until

the transfer of manu-

facturing responsibilities to the Los Angeles plant in the early 1950's.

6) Combining television and radar techniques, RCA created a new system of air navigation and air traffic control known as Teleran (Television Radar Air Navigation). Introduced to the commercial industry on December 8, 1945, the system

8) To satisfy increasing demand for commercial and military airborne radar, RCA established this plant on West Olympic Boulevard, Los Angeles, CA in 1951. The plant became the West Coast Engineering Section of EPD, Camden, NI.



7

The Radiation Section of RCA EPD, Camden, managed by A.F. Coleman, designed and developed transmitters, receivers, mobile communications and sonar for defense applications. Headquartered in Building #10-7 in 1951, this section was responsible for the development of a series of portable, backpack radios for the US Army and Marine Corps. In 1947, at the request of the US Army Signal Corps, RCA began a program of component miniaturization to develop smaller, lighterweight, portable military communications equipment. The successful result was the design, development and production of a backpack "walkie-talkie" for the Armed Forces, which was half the size, half as heavy and twice as powerful as its World War II prototype. Known as the AN/PRC-8, 9 and 10, these superheterodyne combat radios were produced by EPD, Camden for US Forces in Korea beginning in 1951. Each box was 9x3x17 inches and weighed 18 pounds. The PRC-8 covered the VHF-FM band from 20-28 MHz; the PRC-9, 28-38 MHz; and the PRC-10, 38-55 MHz.

Other pioneering advances in military communications in the late 1940's included the AN/GRC-13 transceiver for the US Marine Corps, the experimental AN/URR-2 receiver for US Navy vessels, and the CV-57, 58, 59,

60 and 61/URC frequency shift receiver converters.

The Special Devices Section of RCA EPD. Camden, under A.H. Kettler, was the fourth section in Custom Products Engineering. This group developed battle announce equipment, sound-powered telephones, intercoms, microphones, infrared devices, loudspeakers, fire control equipment, telephone switchboards and consoles for various Government programs. Production activities for special devices were expanded in 1951, when the RCA plant in Detroit, MI began producing precision subsystem devices under subcontract to EPD, Camden. The Detroit plant was acquired from the Brenkert Light Projection Company, who manufactured arc lamps, 16 mm and 35 mm theatre film projectors.





- 1) The AN/PRC-8, 9 and 10 superheterodyne VHF-FM combat radios were produced by the thousands for US Armed Forces in Korea by RCA EPD, Camden, beginning in 1951. Identically packaged, the PRC-8, 9 and 10 each covered a portion of the VHF spectrum between 20 and 55 MHz. This highly successsful program was the start of a long-term, profitable business in portable military communications systems for RCA Camden.
- 2) To satisfy an urgent need by the US Army Signal Corps for communications equipment to support US troops in Korea, this RCA EPD, Camden project team developed an accelerated production schedule for the AN/ PRC-8, 9 and 10 backpack radios. The schedule was announced on November 3, 1950 by (l-r): Mary Whitney (manufacturing), Clarence Gunther (engineering), Horace Dyson (engineering), Wally Gray (fabrication plant), Harold Zimmerman (purchasing), Howard Schwartz (material control) and Joe Beezer (quality control), Courtesy: Joe Beezer.



Besides the two main products engineering groups, there were four other key activities under RCA EPD's Engineering Division in 1951.

Administrative Control, managed by S.W. Cochran, was responsible for general administrative problems, engineering scheduling and coordination, financial planning and control, and personnel administration. It was located in Building #10-7.

Engineering Service and Standards, under R.W. Pearson, handled a wide variety of activities. Among these were technical publications, photographic services, blueprint files, a model shop, an engineering production shop, parts standardization management and packing design. Activities were located in Buildings #10-6, 13-5, 13-6, 11-4 and 24-1.

Advanced Development, managed by H.J. Schrader, was the forerunner to RCA's Advanced Technology Laboratories. Special projects for application to air navigation and television highlighted this section's work in 1951, which was performed in Building #10-8. RCA's first research in computers began here in 1952.

The final activity of EPD's Engineering Division in 1951 was Technical Administration. Led by Assistant Chief Engineer C.A. Gunther, this group provided technical consultation, systems development coordination and assistance in the exchange of ideas and skills between the numerous engineering sections of EPD.



- 3) US Army Signal Corps customer representatives testing completed AN/PRC-8, 9 and 10 "walkietalkie" radios in Building #17-5, RCA Camden, August 1952.
- 4) Clarence Gunther (middle, camera on belt), RCA EPD's assistant chief engineer, providing on-site troubleshooting assistance to US Forces in Korea, August 1952.

The Manufacturing Division of RCA EPD, Camden experienced tremendous growth in the post-war years. From 1949 to 1952, production area increased by 50 percent, due to expanding facilities at the Camden and Detroit plants, and the addition of the Los Angeles and Moorestown plants.

Managing this tremendous manufacturing organization was the responsibility of Arthur L. Malcarney. General Plant Manager from 1947 to 1953, Malcarney was a tough-fisted manager and one of the most important leaders in the history of RCA Camden. Through his 35-year association with the Camden plant, he became firmly entrenched in the minds and hearts of thousands as "Mr. Camden."

Art Malcarney was truly a self-made man. He joined RCA as a mechanical inspector in the Home Instruments Department in 1933 at the age of 20. Despite having had little formal education prior to joining RCA, he quickly rose through the ranks at the Camden plant. Between 1936-1940, Malcarney's drive and ambition earned him increasing responsibilities as assistant foreman, foreman and superintendent in various component manufacturing activities of the Home Instruments Department.

In 1943, he transferred to the Special Apparatus Department as department manager of fabrication operations, which included the metal and tool shops. Only one year later, Malcarney was appointed manager of all special apparatus manufacturing in Camden. At the close of the war, he transferred to the Tube Department as department manager. There he rapidly organized the manufacturing section for the newly-formed Component Parts plant. Returning to Camden, he was appointed Plant Manager for the component parts operation in 1946, and General Plant Manager of EPD in 1947. For his outstanding performance, Malcarney received the coveted RCA Award of Merit for 1948.

In December 1952, Malcarney's manufacturing organization staff included S.N. Lev, his assistant and acting manager of the Camden plant; M.G. Whitney, manager of the Moorestown plant; M.A. Maurer, Manager of the Detroit plant; A.N. Curtiss, manager of the Los Angeles plant; and H.J. Walter, administrator of quality control. The Camden manufacturing staff under S.N. Lev included F. Drakeman, manager of the fabrication plant; J.P. Barkow, manager of the government plant, T.J. Barlow, manager of the commercial



plant; J.T. Wasson, manager of materials handling; J.E. Beezer, manager of quality control; and F.O. Ziegler, manager of plant engineering.

The RCA Camden fabrication plant was the major supplier of metal parts and assemblies for both the Camden government and commercial plants. It also produced beverage inspection machines, standard racks and cabinets, and professional tape recorders. The fabrication plant was a true job shop, having about 400 shop orders in process at all times. Each shop order listed between one and 1,000 items. Each item ranged in quantity between one and 50,000. Approximately 10,000 different parts were manufactured each month by the Camden fabrication plant in 1952. It consisted of a number of manufacturing units, including a press shop, a machine shop, crystal manufacturing, an assembly shop, subassembly shop, finishing shop, wood working shop, short order and precision shop, and tool shop.

The Camden government plant in 1952 was devoted to manufacturing ground-based and airborne radars, Short-Range Navigation (SHORAN), Long-Range Navigation (LO-RAN), and radio receivers and transmitters for ships, aircraft and manportable applications.

1) Arthur L. Malcarney, general plant manager from 1947 to 1953, was one of the most dedicated and successful leaders of RCA Camden. In his 35-year association with the Camden plant, the tough-fisted manager rose from an assembly line inspector to the ranks of the RCA Board of Directors. He always believed in the workers and business at Camden, and dedicated his efforts to both throughout his career.

The RCA Camden commercial plant produced devices ranging from coils to 50-kilowatt transmitters; from polydirectional microphones to television master monitors. The commercial plant actually built commercial equipment for both commercial and government customers, including 16-mm projectors and special purpose communications equipment.

The Materials Handling Section of RCA EPD, Camden was comprised of seven functional groups which supported all product departments and the general offices at Camden. The Material Control Group was responsible for the planning, operation and maintenance of inventory accounts, ordering for direct shop order requirements, processing floor-shortage paperwork and reject notices and controlling rejected material. The Receiving Group handled the receiving, checking, recording and delivery of all materials purchased for EPD. The Stockrooms Group was responsible for the receipt, storage, and disbursement of all purchased and fabricated parts and assemblies.

- 2) Arthur L.
 Malcarney (second
 from left), general
 plant manager of
 RCA's Engineering
 Products Department,
 Camden, NJ, with his
 staff in 1948.
- 3) The Award of Merit, RCA's highest honor for salaried employees, was presented in 1948 to (front row, l-r) S. Nathan Lev, Charles P. Baxter, Frank M. Folsom, Joseph H, McConnell, J.G. Wilson, L.W. Teegarden and Warren E. Albright, (second row) George N. Phelps, Robert W. Conner, Joseph B. Elliott, Thomas F. McCleary, Lawrence S. Thees and Benjamin L. Aldridge, (third row) Hadley C. Chapman, Robert M. Ryan, Dr. Robert B. Janes, Dr. A.M. Max and Arthur L. Malcarney.





The RCA Camden Packing Group handled the packing of all EPD products, including ordering and warehousing of packing materials. The Warehousing and Shipping Group was responsible for storage and shipment of EPD products to customer destinations. The Trucking Group provided trucking service both within the departments of the Camden plant and between the RCA Camden, Indianapolis, Bloomington, Marion, Lancaster and New York manufacturing plants. Having an internal trucking group saved the company money in transportation costs, while contributing to more efficient productivity at the various RCA manufacturing plants. Finally, the Printing and Mailing Group at RCA Camden provided a printing and mailing service to all product departments and maintained the inventory of advertising and sales literature for dealers and distributors.

The Quality Control Section of RCA EPD, Camden carried out many diversified tasks, all aimed at customer satisfaction. Responsibilities included inspection of incoming purchased material and outgoing EPD products, sampling control inspections at critical points in the production line and supervision of final tests on unit type products.

The last functional group of the RCA EPD organization was the Plant Engineering Section, the "landlord" of the Camden plant. Responsible

for maintaining the plant and its services, this section consisted of approximately 850 employees in 1952, organized into seven groups. The Engineering and Layout Group prepared the necessary engineering, layout and estimate information for all new construction and alterations. The Maintenance and Construction Group carried out the tasks assigned by the Engineering and Layout Group. The Power Plant Group supplied steam and electricity to the main Camden plant, as well as sanitary water (3 million gallons daily in 1952) and compressed air. The Building Services Group consisted of a plant fire marshall, an internal fire department, building

1) Joe Beezer (center, without jacket), RCA EPD's manager of Quality Control, with his staff in Building #8-4, Camden, 1948.



2) Assemblers and solderers of television volume control subassemblies in the RCA Camden Home Instruments plant (Building #3-2), accepting "red feathers" from juvenile representatives of the Camden Community Chest charity organization in exchange for their contributions, 1947. Television production remained at the Camden plant until 1952. Courtesy: Pat Cintione.





3) Lt. John Reese (left) and Cpt. Ed Malone at the headquarters of the RCA Camden Plant Protection Group (Building #17D-2) in 1952. This group, responsible for protection of plant property and maintenance of established security regulations, had as many members as the Camden City Police at the time.



4) The Trucking Group, part of RCA's Materials Handling Section of the Engineering Products Department, Camden, NJ, was responsible for daily runs to Indianapolis, Bloomington and Marion, IN; Lancaster, PA and New York, NY in 1952.

5) A. Stone, backing up to the Building #10 loading dock to receive a shipment of RCA Camden products.

cleaners, elevator operators, receptionists and escorts. The cleaners covered about 2.7 million square feet of office and factory space each night. The receptionists and escorts handled over 5,500 visitors every month. The Plant Protection Group was responsible for protection of plant property and the maintenance of established security regulations. A separate group of the Plant Engineering Section, known as Welsbach, handled services for the Camden plant's peripheral buildings in Gloucester, NJ. Most of the groups within the Plant Engineering Section operated on a 24 hour basis to provide the necessary services for the 27 buildings (2.7 million square feet) of the plant in the 1950's.



Other Post-War Activities at RCA Camden

Since the days of the Victor Talking Machine Company, Camden plant employees were involved in various activities beyond the regular business realm.

The Victor Athletic Association (VAA) was organized for employees interested in extracurricular activities. During the post-war years, thousands participated in organized sports events, picnics, and other social gatherings through the VAA. These activities helped to build a team spirit among workers, both on and off the job. The VAA was run by the employees and sponsored by management. This organization, known today as GE Camden Activities Association (GECAA), continues to offer a variety of social activities to Camden plant employees.

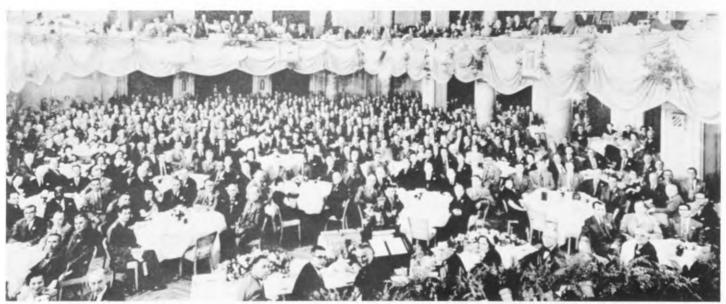
The RCA Victor 25-Year Club was established to honor employees with a quarter century of service to the corporation. It was comprised of both active and retired employees. The Camden plant club, consisting of members who began their careers with the Victor Talking Machine Company, RCA, GE and Westinghouse, held annual banquets in the post-war years to honor new members. By 1954, membership totaled 1,500.

- 1) The Victor Athletic Association (VAA) varsity softball team won its fourteenth title in the Camden Industrial Softball League in 1953. The winning team was (sitting): Russ Slawter, manager, (first row, l-r): Rocky Albano, Tony Billy, John Patryk, Buzz Prince, Nick Haday, Vince Barbati, Ray Di Claudio and George Pipito, (back row, l-r): asst. scorekeeper George Salles, Bob Miller, Hap Horton, Caesar Campano, Whitey Wysocki, Eddie Grock, Bill Reed and scorekeeper Harry Wagner.
- 2) The VAA "stay-at-home" vacation specials included reduced-price tickets to Philadelphia Phillies games at Connie Mack stadium. During an August 29, 1953 Phils-Cubs game, RCA Camden employees introduced Nipper to Benny Bengough, first base coach for the Phillies.
- 3) To establish a better women's program for VAA members, the Women's Activities Committee (WAC) was organized in June 1955. Committee members were (sitting, l-r): Rosalie Wilson, Janice Gracey (chairperson) and Peg Kirk, (standing, l-r): Lorapearl De Martini, Florence Bolt and Betty Katella.









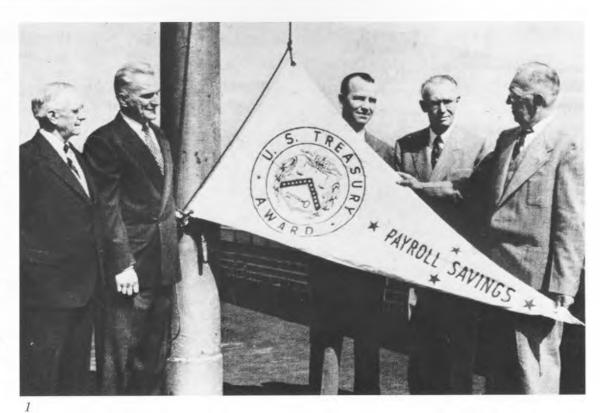




In addition to club activities, Camden plant employees have always been active in fundraising campaigns for both local and national-level organizations. Employee contributions to the Community Chest Campaigns, American Red Cross Blood Drives and the US Treasury Defense Bond Campaigns in the post-war years were numerous. This strong support to charities, community programs and national organizations continued to grow through the years and remains a tradition at GE Camden today.

- 4) The RCA Victor 25-Year Club from the Camden plant, during its annual ceremonial banquet in 1951. Membership totaled 1,500 by 1954.
- 5) In November 1954, the first RCA Camden team to hit the 100% mark in the new Combined Charities Campaign was the Broadcast and Communications group. Proudly displaying their banners were (l-r): Bill O'Callahan, George Weilenman, Tad Dmochowski, Joe Celluci, manager Tom Barlow, Tom McIntyre and Tony Maugeri.
- 6) O.B. Cunningham, manager, Surface Communications Engineering, presenting one of the many gifts that Marie Boileau received from her co-workers for becoming a "Gallon Club" member in September 1955. Red Cross volunteers awarded pins to many RCA Camden employees upon donating their eighth pint of blood. Sharing in Marie's celebration were (l-r): Irv Rose, Chryssie Smith, Fred Schneider, Frank Vandeventer, Ed Lawrence, Ginney Albertson and Tony Pontillo.

1) In recognition of the success of the 1952 Defense Bond Campaign, the RCA Camden plant was awarded the US Treasury's Payroll Savings Flag. Raising the flag over Building #2 were (l-r): Congressman Charles Wolverton; Arnold Weber, EPD personnel manager; John Carter, vice-president and director of finance; E.C. Cahill, president, RCA Service Company; and Russell Britton, US Treasury Department representative.



2) Thousands of patriotic RCA employees gathered on the corners of Front and Cooper Streets, Camden, to see World War II hero and presidential candidate Dwight D. Eisenhower in 1952. Courtesy: Bill Eisenberg.



RCA Tube, Transmitter and Electronic Data Processing Developments (1945-1955)

World War II placed a heavy demand on RCA for manufacturing electron tubes, especially cathode-ray and power tubes. The Harrison, NJ headquarters for the Tube and Equipment Department was augmented by the new plant in Lancaster, PA, which began in 1942 and was purchased by RCA from the Government after the war. Upon the return to peace, RCA electron tubes were built for both commercial and continuing defense system needs. Tubes were built for transoceanic stations, battleship transmitters, home radios, television cameras and television receivers.

A major breakthrough in tube research by RCA Laboratories after the war was the development of a new transmitting tube capable of delivering 500 kilowatts of power. RCA announced this achievement on February 1, 1950. This advance led to the development of the most powerful military radio transmitter in the world, built by RCA EPD, Camden in cooperation with the US Navy. Put into operation on November 18, 1952 at Jim Creek Valley, Washington, the 1,200,000-watt transmitter provided world-wide communications with naval units on land, at sea and in the air.

Pioneering advances in electron tube research led to early successes in electronic data processing by RCA. On March 4, 1947, RCA Laboratories revealed the development of a new electron tube with a "memory" for use in calculating machines to solve complex mathematical problems with lightning speed. Called the *Selectron*, this electrostatic storage tube contained a matrix of 256 small memory elements for use in computers.

Another new electron tube, which acted as a "transducer" in converting mechanical vibrations into electrical pulses that could be studied as audio or video signals, was announced by RCA on October 20, 1948. On November 10, 1949, a new visual memory tube, the Graphecon, was announced by RCA. It could reproduce, for as long as one minute, traces or other electrical signals occurring in as short an interval as a billionth of a second. About this same time, RCA Laboratories also developed the Direct View Storage Tube, allowing brighter displays of radar signals on oscilloscopes. Development of a new pencil-type triode transmitting tube for use at frequencies up to three Gigahertz was announced on November 15, 1949. Six days later, the company announced the development of a photo-multiplier tube six times more sensitive than its predecessor.

The first major contribution by RCA in the





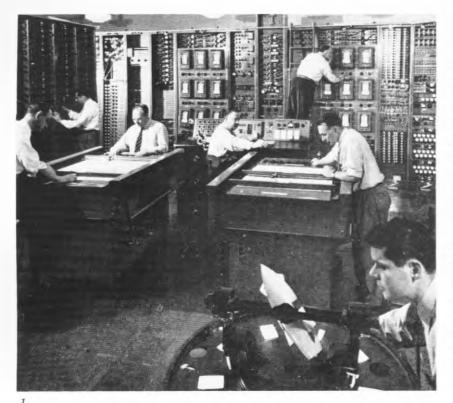
2

computer field was the development and demonstration of the largest and most accurate electronic analogue computer ever built to evaluate performance of guided missiles, airplanes, ships and submarines. Designated "Project Typhoon," the system was demonstrated to the US Navy customer at RCA Laboratories on November 21, 1950. The computer employed approximately 4,000 electron tubes and several miles of wiring. It was able to solve, in a few seconds, problems that would require months of computation by a mathematician. Typhoon could work out a complex air defense problem employing a theoretical guided missile in one minute. The system was used in more than 2,000 simulated test runs of guided missiles, saving the US Government over \$250 million.

During the National Convention of the Institute of Radio Engineers on March 21, 1951, RCA announced development of a new gas-discharge tube. Called the *Plasmatron*, it provided a new means of high-speed power control and radio circuit operation.

These rapid developments in the electron tube field were incorporated into systems for the US Government at an increased pace during the Korean Conflict. Increased demand for electron tubes necessitated additional RCA manufacturing facilities. New plants were added at Cincinnati, OH in 1951 and Woodbridge, NJ in 1953 to

- 1) Rapid advances in electron tube developments, coupled with the outbreak of war in Korea, led to increasing demand for production of tubes for US defense programs. RCA established the Cincinatti, OH plant in 1951 for additinal tube manufacturing.
- 2) RCA electron tube manufacturing expanded further in 1953, with the addition of the Woodbridge, NJ plant.





satisfy demands of both government and commercial customers.

Beginning in 1952, RCA Camden engaged in an intensive program of research and engineering in electronic systems for computing, sorting, filing and recalling large quantities of data. The commitment to enter the electronic data processing field was made by Chairman of the Board David Sarnoff, following a visit in 1953 to the Camden plant. Impressed by presentations and demonstrations conducted in Building #10-8 by Loren Jones and others, Sarnoff allocated the requested \$10.6 million investment.

The successful result of this R&D program was the BIZMAC (Business machine) electronic data processing system. This work was spearheaded by J.W. Leas, chief product engineer, and his computer engineering group. The first production system was shipped in December 1955 to the US Army Ordnance Tank Automotive Command in Detroit, MI. It contained a computer, three sorters, 182 tape stations, and 28 input and output devices for handling punched cards, punched paper tape and high-speed printing. The total equipment complement contained about 27,000 tubes and 67,000 diodes. The system occupied more than the entire second floor of Buildings #10/13 during assembly, which was an area equivalent to a regulation football field, including the end zones. The \$5 million system was placed into operation in Detroit in October 1956, where it successfully tracked over 100 million tank and automotive spare parts in the Army's worldwide inventory. BIZMAC was, at that time, the world's largest electronic "brain."

- 1) RCA Laboratories produced the "Typhoon" analog computer for the US Navy in 1950. The computer, containing 4,000 electron tubes and several miles of wire, simulated tests of guided missiles. By 1953, more than 2,000 simulated tests were run saving the Government over \$250 million in time and materials.
- 2) Art Malcarney, RCA EPD, Camden production manager, explaining convenient push-button features of the RCA BIZMAC electronic data processing console to a customer representative from the US Army Ordnance Tank Automotive Command (OTAC) in Building #13-2, 1955. The first production model of the world's largest electronic "brain" was delivered to OTAC in December 1955.

Other RCA Highlights: RCA Laboratories

In addition to the significant advances in television, defense electronics systems, broadcast equipment, scientific instruments, phonographs and records, RCA Laboratories excelled in other research activities in the post-war era.

After the war, RCA broadened its research activities at its Princeton and New York locations. The Industry Service Laboratory (ISL) of RCA Laboratories made significant contributions in the radio field. Located in the former offices of NBC at 711 Fifth Avenue, New York, ISL was devoted to the development of radio-electronic weapons throughout the war. On October 3, 1945, RCA revealed the development of a new FM radio circuit, the Ratio Detector. Invented by Stuart W. Seely, manager of ISL, the device was a major advance in FM broadcasting. A number of other important circuit devices for automatic, precise receiver tuning were developed by the engineers in New York. ISL, which began in 1930 as the RCA License Division Laboratory, was also a service organization for the company's licensees. It provided technical information and engineering assistance to licensees engaged in the manufacture of receivers and electron tubes.

Communications-electronics research activities at RCA's Princeton Laboratories were extensive. Among the many post-war achievements was the development of advanced radio relay systems. On October 1, 1945, two radio relay systems, developed in collaboration with the Camp Cole Ground Signal Agency, demonstrated eight channels on a single carrier frequency. On October 22, RCA and Western Union Telegraph Company jointly announced the establishment of the first link in an automatic microwave relay system. With radio beams working in both directions between terminals, the system provided 270 multiplex circuits.

Development of a revolutionary system of high-speed communications capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute was announced by RCA on June 23, 1947. Known as "Ultrafax", the system was publicly demonstrated at the Library of Congress on October 21, 1948. It was a joint development between RCA Laboratories and Eastman Kodak Company.

On October 26, 1948, RCA Laboratories demonstrated a new electronic reading aid device, which scanned individual letters and reproduced their sounds through a loudspeaker.



1) Receiving terminal of the revolutionary RCA "Ultrafax" highspeed communications system, a joint development between RCA Laboratories and Eastman Kodak Company. First demonstrated to the public on October 21. 1948, Ultrafax was capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute.

Expanding RCA research necessitated additional facilities. A new laboratory was erected for scientific projects conducted under US Army and Navy contracts. Also, a threestory wing was added to the main building at the Princeton Laboratories and new tube testing facilities were established at Newark, NJ, under the direction of the Industry Service Laboratory. Other laboratories of RCA were located in Riverhead and Rocky Point, NY: Chicago, IL; Hollywood, CA; and Washington, DC.

On September 27, 1951, the RCA Laboratories at Princeton were dedicated as the David Sarnoff Research Center in appreciation of General Sarnoff's "faith in science, penetrating vision, constructive planning and enduring achievements in the fields of radio, television and electronics." The occasion commemorated his 45th anniversary in the field of radio.

Bell Telephone Laboratories research in semiconductor materials led to development of the transistor. RCA Laboratories also began studies in the use of solids, in place of tubes, for the flow and control of electrons. Research in transistor devices resulted in the development of point-contact transistors which oscillated at frequencies up to 200 MHz. This significant advancement, announced on June 26, 1952, led to milestone achievements in component and system miniaturization in many RCA products. The first demonstrations of transistors in practical devices were held at Princeton on November 17, 1952.

Transistors were shown operating an experimental television receiver, radio sets, loudspeaker systems, miniature transmitters, and parts of electronic computers. An experimental model of a small atomic battery, which converted nuclear energy into electricity, and which operated a transistor to produce audible sounds, was displayed by Sarnoff on January 26, 1954.

In 1955, RCA Laboratories developed an alloy-junction "drift" transistor which had higher frequency performance and operated faster than previous transistors.

Another major development at RCA Laboratories was "Electrofax," a high-speed electrostatic printing process, introduced in 1954. It subsequently was licensed to photocopier manufacturers.

Four new major developments were disclosed by General Sarnoff in New York on January 31, 1955: an electronic music synthesizer, an electronic cooling system, an electronic light amplifier and an improved TV magnetic tape recorder. These were all the result of pioneering research activities at RCA Laboratories.

Other RCA Highlights: NBC

Post-war advances in monochrome and color television brought tremendous growth in programming and network services at NBC. In order to provide more efficient broadcasting services of both radio and television, NBC was reorganized in 1949 into three major divisions: one for the radio network, one for the television network and one for the stations which NBC owned and operated.

The NBC Blue Network, led by New York station WJZ, was sold on July 30, 1943 to Edward Noble. Noble then formed the American Broadcasting Company (ABC) as the third major US broadcasting company. Station WJZ became WABC. Despite the wartime sale of the Blue Network, NBC's Red Network was the nation's largest in the post-war radio-television industry.

The NBC radio network consisted of 172 stations in 1949, six of which were owned and operated. Of the 166 affiliates, 93 operated FM stations in addition to standard AM stations.

The NBC television network more than doubled in size between 1948 and 1949, growing from 22 to 56 stations. Of these, NBC owned and operated five. The pioneering UHF station near Bridgeport, CT, opened in 1950,

acted as a "satellite" receiving and retransmitting station for WNBT, New York.

Many outstanding stars of NBC were seen by the public for the first time on television in 1950: Fred Allen, Eddie Cantor, Jack Carson, Jimmy Durante, Bob Hope, Kate Smith and Danny Thomas.

NBC news coverage was progressively broadened in the post-war years. By 1950, seven NBC newsrooms across the country produced 441 news programs weekly for local and network broadcasting. America witnessed the events of war in Korea via NBC correspondents. Extensive coverage was made in 1951, NBC's Silver Anniversary.

A significant technical advance by NBC was the development, in 1946, of a miniature radio receiver for studio use. Known as the "Pocket Ear," the device was small enough to carry in a coat pocket. Used for communication between the control rooms and studio stages, it provided a means of "talkback" without the cumbersome trailing wires of former systems.

Other RCA Highlights: RCA Communications, Inc.

Applying new operating techniques and methods developed during World War II, RCA Communications, Inc. continued as a pioneer in international service in the post-war years.

By 1946, RCA had reopened all direct circuits suspended during the war and had expanded its service by opening additional radiotelegraph, radiotelephone and radiophoto circuits. Worldwide radiotelegraph circuits of RCA Communications totaled 86 at the end of 1949, linking the United States with 66 foreign countries. Powerful short-wave stations in Manila, Tangier, Honolulu and the Caribbean were enlarged to facilitate rapid message relaying to distant commercial stations. Direct radiophoto service between New York and Capetown was established in 1949, bringing the number of RCA-operated radiophoto circuits to 24.

Under contract with the Department of the Navy, RCA Communications began designing the antenna and ground systems for the 1000-kilowatt transmitting station at Jim Creek Valley, near Seattle, Washington in 1949. By 1951, design of the world's most powerful transmitting station was completed.

On May 15, 1950, for the first time in communications history, direct customer-tocustomer radioteleprinter connections on an international scale were made publicly available by RCA. A two-way service, called "TEX," was inaugurated between New York and Holland. West Germany and Denmark were added to the subscriber list later that year. Continuing progress was made in the next several years in converting from manual operation to semi-automatic tape transmission. Most RCA circuits were equipped for teleprinting by the early 1950's and, by 1955, TEX service was available to thirty foreign countries.

New electronic, four-channel multiplex equipment was developed in 1950, with installations commencing the following year. This development enabled increased message capacity without requiring additional frequencies.

New RCA radiotelegraph circuits were added between the Philippines and Israel and between Cuba and Venezuela in 1951. By 1955, RCA Communications operated 94 radiotelegraph circuits connecting principal trading centers in 66 foreign countries. Radiophoto service was extended to 43 overseas stations from the United States *via RCA* by 1955.

Other RCA Highlights: RCA International Division

The post-war years at RCA were also marked by significant growth in international business activities. The RCA International Division was engaged in the sale and installation of radio communications equipment, electron tubes, radio and television sets and phonograph records around the globe. In the field of broadcasting, the division's customer list grew to include Colombia, Venezuela, Brazil, Mexico, Saudi Arabia, Israel, Burma, Thailand, Japan, Pakistan and Indonesia. Beginning in 1949 with the first television transmitter sale to Brazil, RCA television broadcast equipment became a major product for the international market.

In 1950, RCA sold over 500 broadcasting and communications transmitters to 45 countries. The US State Department purchased RCA equipment for the "Voice of America," the organization which sends freedom's message throughout the world.

The International Division was also responsible for bringing "His Master's Voice" to countries throughout Latin America. An RCA Victor record plant was established in São Paolo, Brazil in 1949. Record materials

manufacturing plants were built in Chile and Argentina by 1950. Major RCA entertainment products for export included phonograph records, radio-phonograph combinations, 16mm projectors and sound systems.

Another popular RCA electronic product in the international market was marine radar. By 1951, nearly 900 foreign-registered vessels were equipped with RCA marine radars.

By the mid-1950's, the International Division had generated considerable income for RCA, due in large part to the expanding market for television.

Other RCA Highlights: Radiomarine Corporation of America

Advances in wartime research and development by Radiomarine Corporation of America were made available to the commercial industry upon the return to peace.

New lifeboat radio equipment that automatically transmitted SOS and radio direction-finding signals, capable of operating at distances in excess of 1,000 miles, was announced by Radiomarine on April 3, 1945. On June 4, 1947, the US Army Corps of Engineers revealed a method of making river navigation charts using a mosaic of photographs of radar images taken from the scope of Radiomarine's 3.2-centimeter radar equipment.

Opening a new market in 1949, Radiomarine was the first to introduce a lowpriced small vessel radar. It was specially adapted for use on small tankers and cargo vessels, as well as fishing boats, tugs, ferries and yachts. Over 300 units were sold and installed within a year.

Radiomarine communications and direction-finding equipment was developed for major American passenger vessels, beginning in 1949. The SS United States sailed on its maiden voyage on July 3, 1952, exclusively equipped with radiotelephone, radiotelegraph, various transmitters and receivers manufactured by Radiomarine.

A complete modernization program of Radiomarine coastal stations, begun in 1946, was completed in 1949. Thirty-seven new transmitters were included in the upgrade.

New developments in 1949 included a new type of direct-reading long-range navigation (LORAN) system, 68 of which were purchased by the US Coast Guard for its cutters. A "packaged" radio station for ocean liners was designed. It consisted of 500-watt medium and

high-frequency transmitters, receivers and a compact, eight-channel radiotelephone—all in a single cabinet.

In 1950, Radiomarine began expanding activities in special equipment for the Armed Forces and other Government agencies. New radiotelegraph receiving equipment, called "Unicast," was designed and demonstrated to Government officials. During the growing US defense production effort in 1951, a substantial amount of Radiomarine equipment and services were suppled to US ships being restored to military transport service.

A new shore station was opened at Pittsburgh, PA in 1951, serving vessels on the Ohio, Allegheny and Monongahela rivers. Radiomarine maintenance and service contracts for shipboard electronic equipment totaled more than 2,500 by the mid-1950's, for both military and commercial customers.

Other RCA Highlights: RCA Institutes, Inc.

Following the war's end, RCA Institutes, Inc. began to introduce courses in commercial radio and television servicing, radio and television broadcasting and advanced technology to students preparing for technical positions in the industry. Annual enrollment in 1949 reached 2,400, two-thirds of which were World War II veterans.

Laboratory and classroom facilities were acquired at 350 West Fourth Street, New York City, where day and night classes were taught 50 weeks each year. A home-study course in television receivers was offered to RCA Service Company technicians in 1950, then to all students in 1951.

In 1945, the RCA Board of Directors established an educational program of scholar-ships and fellowships to encourage the training of personnel for the growing radio-television and electronics industry. By 1953, over 100 students completed their college studies under the RCA Scholarship Plan. The Plan was extended to 25 educational institutions across the country, as well as young scientists and engineers of RCA Laboratories and operating units of RCA.

Other RCA Highlights: RCA Service Company, Inc.

With the post-war introduction of RCA television to the public and the growth in defense electronics, the RCA Service Company, Inc. played an increasingly more important role

in the corporation.

By 1951, the RCA Service Company operated in every state in the Union. Television service branches were established in all areas of television coverage. In addition to consumer radio and television, the Service Company was active in many fields of electronics. It was responsible for installing broadcast transmitters, theatre equipment, electron microscopes, shortwave and microwave communications systems and industrial electronic equipment.

The Government Services Division, organized in 1938, experienced continued growth during the Korean Conflict. The field service activity was stepped up significantly. By 1951, approximately twice as many trained RCA field engineers were assigned to military activities as compared with the peak of World War II. Operating in over 20 foreign countries, their job was to keep the Armed Forces' communications and other electronic equipment operating in Korea and on island outposts in the Atlantic and Pacific. RCA Service Company representatives were also present at major domestic military bases, providing valuable assistance in training and operating equipment.

In 1954, the Service Company began a program which was to become one of the most significant RCA contributions to national defense. It had won the contract for maintenance and analysis of electronic missile guidance equipment at the US Air Force Missile Test Center, Cape Canaveral, Florida.

1) R.E. Higgs (left) photo lab manager for the US Air Force Missile Test Center, Patrick AFB, FL, welcomes visiting RCA representatives (l-r): A. Conrad; W.W. Watts, vice-president, EPD; P.B. Reed, vicepresident, RCA Service Company; E.W. Sheridan; T.A. Smith, vice-president and general manager, EPD; S.D. Heller; and K.M. McLaren, February 14, 1955. The Service Company's Government Service Division was awarded the contract for the maintenance and analysis of electronic missile guidance equipment as part of the Missile Test Project in 1954. Courtesy: T.A. Smith.



RCA Organizational Realignment (1954)

The post-war electronics explosion in America brought rapid growth in many new fields at RCA. The RCA Victor Division expanded rapidly. By 1953, RCA Victor sales were nearly 13 times its 1939 pre-war sales and more than double its sales of 1949. The Division consisted of 14 manufacturing plants in 1953, compared to six before World War II.

To increase its flexibility to meet changing customer needs in a changing industry, a major corporate-wide realignment was instituted on January 11, 1954. The seven former RCA Victor product, sales and service units, along with Radiomarine Corporation of America and RCA Institutes, Inc. were aligned in three "family" groups: Consumer Products, Electronic Products and Sales & Service Subsidiaries. Consumer Products consisted of the RCA Victor Home Instrument Division. RCA Victor Record Division and RCA Victor Home Appliance Division. Electronic Products consisted of the Engineering Products Division (formerly a Department), Tube Division and Radiomarine Corporation of America. Sales and Service Subsidiaries consisted of RCA Service Company, Inc., RCA Victor Distributing Corp. and RCA Institutes, Inc.

The changes were made in order to decentralize profit responsibility, while centralizing and sharpening staff responsibility. The three new groups represented the second level of management, with a newly established position of group executive to supervise each. J.B. Elliott was promoted to head Consumer Products, Robert A. Seidel was promoted to run Sales & Service Subsidiaries and W. Walter Watts was promoted to manage Electronic Products.

At the same level as the three new groups, the other RCA subsidiaries were realigned to report directly to top management: RCA Laboratories, NBC, RCA Communications, Inc. and RCA International Division.

As a result of these changes, the RCA Victor Division ceased to exist as an operating entity. However, the name "RCA Victor" was retained, together with "His Master's Voice," as valued symbols of quality.

The Engineering Products Division became the new title for the Camden-based business. Expanded business activities in both commercial and defense electronic products resulted in the need to realign EPD into two separate groups, which happened in 1956.



Realignment of EPD (1956)

The tremendous growth of the military and commercial businesses of the Engineering Products Division necessitated further realignment in 1955. Headquartered at Camden, EPD had expanded to include new plants in Los Angeles, CA (1951) and Moorestown, NJ (1953). In 1955, a flight laboratory was established in New Castle, DE, an airborne systems laboratory was set up in Waltham, MA and a field systems studies group was organized in Tucson, AZ. This expansion was mainly due to the growth, in both volume and importance, of business with the US Department of Defense.

Effective January 1, 1956, EPD was reorganized into two new groups: Defense Electronic Products (DEP) and Commercial Electronic Products (CEP). T.A. Smith was elected Executive Vice-President, DEP. A.L. Malcarney was named Vice-President and General Manager, CEP. The new DEP organization consisted of five primary staff activities, two line-service departments and five operating departments. The staff activities were: Technical Administration, Defense Plans and Programs, Defense Projects, Operations Control and the Washington, DC Office. Defense Engineering and Defense Production were the two line-service departments organized to support the operating departments.

2) Theodore A. Smith was named Executive Vice-President of the newly-reorganized RCA Defense Electronic Products in 1955. Smith joined RCA in 1925 upon graduation from Stevens Institute of Technology. His first assignment was at the Van Cortlandt Park laboratory, under Dr. Alfred Goldsmith. In 1928, he was put in charge of television development, where he constructed RCA's pioneering experimental station W2XBS. From 1931 to 1938, Smith held various assignments in radio broadcasting sales engineering in New York. He moved to Camden in 1938, where he held assignments of increasing responsibility in product planning and marketing for television and the electron microscope. During World War II, he was involved in various development programs for TV guided missiles, magnetic airborne detectors. sonobuoys, and others. His first post-war Camden assignment was in heading the effort to equip television stations with EPD broadcasting products. He was promoted to Assistant General Manager, EPD in 1951 and Vice-President in charge of EPD in 1953.

The five new operating departments of RCA Defense Electronic Products were: Missile and Surface Radar Department, Moorestown, NJ; West Coast Electronic Products Department, Los Angeles, CA; Airborne Systems Department, Camden, NJ; Surface Communications Department, Camden, NJ and Special Systems and Development Department, Camden, NJ.

The Missile and Surface Radar Department, headed by H.R. Wege, was responsible for surface radar systems, missile equipment and display systems. It also managed a missile operation at White Sands, NM.

The West Coast Electronic Products
Department, managed by A.N. Curtiss, produced
missile components, airborne navigational and
weather radar for both military and commercial
use, and electronic countermeasure equipment.

The Surface Communications Department, run by S.W. Cochran, built land-based portable and heavy communications equipment. The Field Systems Studies Group, Tucson, AZ and the Surface Communications Systems Group, New York, NY, became part of "Surfcom."

The Airborne Systems Department, under J.M. Hertzberg, was responsible for airborne fire control, airborne communications, infrared devices, airborne and portable TV systems and other missile electronics. The Flight Laboratories, New Castle, DE and the Airborne Systems Laboratory, Waltham, MA became part of ASD.

The Special Systems and Development Department, managed by Dr. C.B. Jolliffe, was involved in various advanced electronics research







2

- 1) Dr. Elmer W. Engstrom, executive vice-president, RCA Laboratories (right) was the guest speaker at a testimonial dinner in the Broadwood Hotel, Philadelphia, November 16, 1955 for Art Malcarney. Over 1,000 guests attended the dinner, celebrating Malcarney's appointment to General Manager, Commercial Electronic Products, Camden, NJ.
- 2) In 1955, RCA's Engineering Products Division, Camden, set up a new Field Systems Studies Group in Tucson, Arizona, in an effort to expand military communications business with the US Army at nearby Fort Huachuca. The Tucson activity, as well as the New York City communications systems plant, became part of the new Surface Communications Department, Defense Electronic Products, Camden, NJ in 1956.
- 3) T.A. Smith (seated, center), executive vice-president for the newlyorganized RCA Defense Electronic Products, Camden, NJ, and his staff, July 1956.
- 4) John L. Burns (second from left), elected President of RCA in January 1957, received a tour of DEP facilities, which included the newly-expanded and rededicated Moorestown, NJ radar plant. Accompanying Mr. Burns on the May 1957 tour were (l-r): Ted Smith, executive vice-president, DEP; Harry Wege, manager, Missile and Surface Radar; and Art Malcarney, vice-president and general manager, CEP. Less than one month later, Malcarney and Smith traded positions. Smith was appointed Executive Vice-President, Industrial Electronic Products (formerly CEP) and Malcarney became Executive Vice-President, DEP. Courtesy: T.A. Smith.

and development projects. RCA Laboratories, Princeton, NJ, provided systems engineering support to this Camden-based "think-tank".

Commercial Electronic Products, Camden, was responsible for all broadcasting equipment, theatre sound systems, commercial computers and scientific and industrial instruments.

CEP was renamed Industrial Electronic Products (IEP) in 1957, at which time two executive changes were announced. T.A. Smith was appointed Executive Vice-President, IEP, moving from DEP. A.L. Malcarney was elected to succeed him as Executive Vice-President, DEP.

Financial Summary (1945-1955)

The explosive growth of commercial and military electronics in post-war America was due to the pioneering advances during World War II by many companies, including RCA. Post-war growth of RCA was swift and sizable. A \$280 million a year corporation with 40,000 employees in 1945, RCA became a \$1 billion a year corporation with 80,000 employees in 1955. And this was just the beginning. The advent of television, solid-state devices and electronic data processing opened new avenues for further RCA growth in the years ahead. America was about to enter a new era of pioneering in computers and space exploration, and the Radio Corporation of America would play an important role in both.





Chapter 8

The Age of Computers and Space Exploration (1956-1967)

"As electronics broadens its contributions to the nation and the individual, and its influence extends around the globe and deep into space, new dimensions of service as well as new concepts of opportunity come into focus."

 Dr. Elmer W. Engstrom President of RCA, 1963

he year 1955 was recorded as the "Golden Achievement Year" in the history of the Radio Corporation of America, the year in which sales exceeded \$1 billion for the first time. The post-war revolutionary transformation in the nature of electronics, due to advances in the development and application of semiconductor devices, opened the door to new opportunities for RCA. The corporation advanced rapidly in the new age of computers, making significant contributions to both the commercial business industry and national defense programs. As America entered the Space Age, RCA played a pivotal role in developing advanced technologies and systems to support the nation's continued progress on this new frontier.

The period 1956-1967 was characterized by vigorous growth at RCA in a variety of key activities, including military and space communications, semiconductors, computers, color television and home instruments. During this time, the corporation would triple its sales, becoming one of the leading industrial companies in the United States. By 1967, *The World's Most Recognized Name in Electronics* would exceed \$3 billion in annual sales.

RCA Semiconductor Division: Formation and Early Developments

RCA began its efforts in semiconductors in 1948 with four engineers, two technicians and a budget of \$4,523. The first formal semiconductor department was established in 1953 and the first RCA transistors were introduced that year.

The first free flight test of the Minuteman Intercontinental Ballistic Missile (ICBM) from the US Air Force Missile Test Center launching site, Cape Canaveral, FL, February 1, 1961. The arrival of the Space Age brought a new dimension to research, development, manufacturing and service activities at RCA.

Recognizing the importance of semiconductor devices for future product applications, RCA created a new division in 1955 to design, develop, manufacture and market such devices. A new plant was constructed in 1956 at Somerville, NJ, where transistors and crystal diode rectifiers were developed and manufactured for use in consumer, industrial and defense products. This added capability allowed RCA to make rapid advances in the fields of computers, miniaturized consumer electronics, portable military electronic systems and space-based devices.

The RCA Semiconductor Division, together with the Electron Tube Division (headquartered at Harrison, NJ) and the Components Division (Building #60, Camden, NJ), comprised RCA Electronic Components in 1957. This organization was headed by W.W. Watts, executive vice-president.

The Semiconductor Division became a major producer and technical innovator for discrete semiconductors during the middle and late 1950's. One of the early noteworthy achievements by the division was the development of transistors for RCA miniaturized radios. The result was the introduction, in 1959, of the first RCA transistor radio to the consumer market.

Facing intense competition, RCA Semiconductor rapidly expanded beyond the manufacture of germanium transistor devices. In 1958, the Findlay, OH plant was converted from a manufacturing center for television components to a production facility for transistors, diodes and rectifiers. The Findlay plant became part of the renamed RCA Semiconductor and Materials Division.

By 1962, the division had become the leading domestic producer of solid-state semiconductor devices for consumer products, with over 100 million of its germanium units in use.

RCA Tube and Electronic Components Developments

In addition to early advances by the RCA Semiconductor Division, the RCA Electron Tube Division moved aggressively in the late 1950's and introduced new products to the component market.

The Electron Tube Division concentrated on heavy-duty and special-purpose tubes in the 1958-1962 period, with considerable success. Some 800 new tubes were developed and manufactured by the various RCA plants at Harrison and Woodbridge, NJ; Indianapolis, Bloomington and Marion, IN; Cincinatti, OH,



and Lancaster, PA.

In 1959, the division announced the revolutionary *Nuvistor*, a receiving tube the size of a thimble incorporating high reliability and durability. The success of the *Nuvistor* was evidenced by the production of the one millionth unit at the Harrison plant in July 1961.

Another advance by the Electron Tube
Division was the 1960 introduction of a new line
of metal-to-ceramic power tubes for transmitters,
known as *Cermolox* tubes. The famed *Pioneer V*Venus probe carried one of these devices.
Concurrent with the introduction of *Cermolox*tubes, the division began to manufacture solidstate photoconductors and silicon solar cells.
The advance in solar cells was a result of RCA
Laboratories research for the US Army Signal
Corps for both military and space applications.

RCA Laboratories made significant breakthroughs in circuit technologies in the early 1960's. In 1963, the Laboratories developed a low-voltage, low-cost, insulated-gate metal-oxide semiconductor (MOS). Research in integrated circuits (IC) progressed rapidly over the next few years. In 1967, the Laboratories developed a silicon-on-sapphire (SOS) fabrication technique for producing large arrays of silicon field-effect transistors. The following year, it announced the first complementary MOS (CMOS) IC.

To further coordinate circuitry and component operations, RCA consolidated the Semiconductor and Materials Division with the Electron Tube Division in 1963 to form a new operating unit, known as RCA Electronic Components and Devices. This newly integrated group immediately began a program to develop and produce IC's, making its full-scale entry into the market in 1965 with an initial line of 17 types. By 1967, RCA Electronic Components and Devices had become a major producer of IC's for computers, communications and instrumentation systems, industrial and military electronic systems.

1) In 1956, RCA opened a new plant at Somerville, NJ for the design, development and manufacture of semiconductor devices. This became the home of the RCA Semiconductor Division, which was organized the year before.

RCA Enters the Computer Age

With the successful installation of the first BIZMAC (business machine) electronic data processing system at the US Army Ordnance Tank Automotive Command (OTAC) at Detroit in 1956, RCA began an aggressive program under J.W. Leas and the Camden engineering team to become a leader in the growing computer industry.

In 1957, RCA Camden began production of additional BIZMAC systems for the New York Life Insurance Company and the Travelers Insurance Company, Hartford, CT. The latter was, at the time, the nation's largest commercial multi-computer system. Both installations consisted of a complete group of peripheral equipment, including card readers and punches, paper-tape readers and high-speed printers.

Investigations in the use of transistors to implement the logic of electronic data processing systems were started at RCA in 1955. A prototype transistorized computer was developed by 1958, and the Camden-based Commercial Electronic Products (CEP) group was ready to launch into a major venture.

The RCA 501 System

In 1958, RCA Camden developed the world's first all-transistorized business computer—the RCA 50l System. Designed for business data processing, the 50l consisted of a central computer with high-speed core memory, up to 63 magnetic tape stations and a complete line of peripheral equipment, including card readers and punches and high-speed printers.

- 2) The pioneering efforts in electronic data processing at RCA Camden in the early 1950's resulted in the success of BIZMAC, the world's largest electronic brain, in 1955. Comprised of 357 separate equipment units, with over 25,000 electron tubes, the system covered about 20,000 square feet. The advent of solid-state devices in the mid-1950's enabled RCA to launch into the Computer Age with a new line of transistorized units, beginning in 1958.
- 3) The revolutionary RCA 501 System, introduced in 1958, was the world's first all-transistorized business computer. Designed and built by Commercial Electronic Products, Camden, NJ, the 501 found widespread use among commercial and industrial firms, both domestically and abroad.





The first RCA 501 Electronic Data Processing Center was opened at the RCA Cherry Hill, NJ offices in June 1959 to handle data processing for firms in the Philadelphia area and to serve as a demonstration and training center for RCA personnel and customers. The RCA Service Company established the Electronic Data Processing Services Department that year, and began construction of a modern, two-story training center at its Cherry Hill headquarters in 1960. A second 501 center to serve financial institutions and other businesses in New York's financial district was opened in February 1960, and a third center began in Washington, DC in May 1960. By 1962, RCA data processing centers were added in Chicago, IL and San Francisco, CA.

To allow more flexibility in its growing computer business operations, RCA announced a further organizational realignment in 1961. A new group, RCA Electronic Data Processing, was established under T.A. Smith, executive vice-president. A new manufacturing plant was dedicated at Palm Beach Gardens, FL on May 25, 1961.

By the mid-1960's, the RCA 501 System was serving such major insurance firms as the New York Life Insurance Company, The Travelers Insurance Company, Hartford, CT, and State Farm, Bloomington, IL. Other applications included: handling personnel records for the US Air Force; helping the New York Telephone Company speed delivery of millions of directories; bookkeeping and billing support to the public utilities firms of Atlantic City Electric

Company and the Niagra-Mohawk Power Company; and handling records for Crucible Steel Company, General Tire and Rubber Company and Owens-Corning Fiberglas Corporation.

Other RCA Commercial Computer Systems: The 301, 601, 3301 and Spectra 70

The successful introduction of the RCA 501 System was followed by the development and introduction, in April 1960, of the compact RCA 301 System for smaller business applications and the RCA 601 for larger enterprises. The first RCA 601 System was delivered to the New Jersey Bell Telephone Company and became operational in December 1962. By 1963, an installation of one RCA 601 and four RCA 301 Systems processed the toll records of 14 million monthly phone calls handled by the Teaneck, NJ office of New Jersey Bell.

In 1959, RCA introduced "Da SPAN," a digital communications systems that linked a central computer with numerous remote stations via telephone or telegraph lines. This two-way, computer-to-computer system could span a continent, providing an efficient and economic means to gather and sort data for companies with locations scattered across the country.

Early RCA successes in the domestic computer market were extended in the early 1960's. A series of multi-million dollar export sales agreements with three of the world's leading computer equipment manufacturers—in Great Britain, France and Japan—were concluded in 1961. The three firms ordered 158 RCA systems in late 1962, resulting in approximately \$90

2) Due to the growth of its commercial computer business, RCA established a plant at Palm Beach Gardens, FL for additional manufacturing capability. Ground was broken in August 1960 and the \$4 million Electronic Data Processing Center was dedicated on May 25, 1961. The first shipment was an RCA 301 System to the Chase Manhattan Bank in New York. Eventually, all commercial computer operations were transferred here from the Camden plant.

1) To satisfy the computing needs of businesses with a lesser volume of data, RCA Camden introduced the RCA 301 System in April 1960.





million in sales.

In 1963, RCA introduced the "3301 Realcom," the first computer designed to span the full range of data handling capabilities in a single system—business data processing, high-speed communications, real-time management control and scientific computation.

Continuing progress in circuit design and systems engineering led to the 1964 introduction of the RCA "Spectra 70" series of computers. The initial line consisted of four models, two of which contained the first monolithic integrated circuits used in commercial equipment. The models were titled the Spectra 70/15, 70/25, 70/45 and 70/55. By 1966, these systems were serving the computing needs of insurance companies, airlines, railroads, manufacturing companies and US Government agencies, as well as overseas customers.



Realcom, introduced in 1963, was the first computer designed to handle the multiple functions of data processing, high-speed communications, realtime management control and scientific computation in a

single system.

3) The RCA 3301



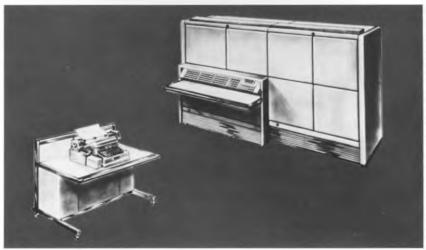
4) The Spectra 70, a new series of third-generation computers, was introduced by RCA in December 1964. Employing the first monolithic integrated circuits in commercial equipment, the Spectra 70 served US Government agencies and industries both domestically and abroad.

RCA Camden's Government Computer Systems: COMLOGNET and AUTODIN

Systems engineering expertise at RCA Camden in computers was extended beyond the realm of the commercial industry in the 1960's. The early 1960's saw the introduction of major communications systems for the US Government which became the basis for much of the digital communications systems business at GE Camden today.

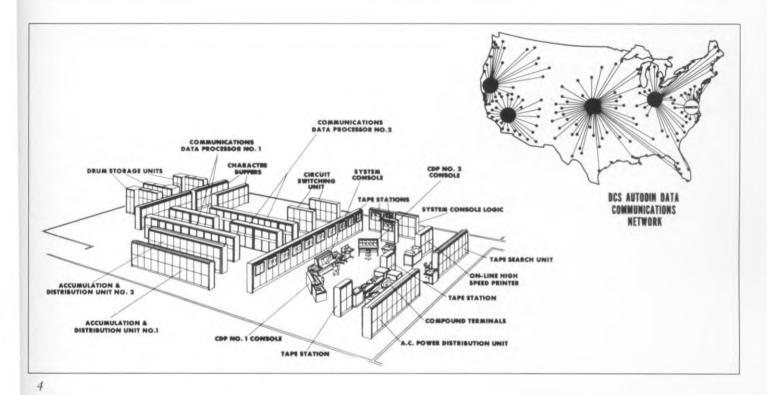
In 1959, under subcontract to the Western Union Telegraph Company, RCA Camden began development of an automatic electronic data switching system for the US Air Force Combat Logistics Network (COMLOGNET). By February 1963, five such systems were installed and operating at the following locations: McClellan AFB, Sacramento, CA; Norton AFB, San Bernadino, CA; Tinker AFB, Oklahoma City OK; Gentile AFB, Dayton, OH; and Andrews AFB, Washington, DC. This network, designated the US Air Force Data Communications Network (DATACOM), represented the keystone in the Automatic Digital Network (AUTODIN), a world-wide common user data communications system which provided both store-and-forward and direct user-to-user circuit switching capabilities for the US Department of Defense. The five domestic switching centers provided service to over 350 military bases and stations across the country. Four additional centers became operationai in 1966, including one in Hawaii, bringing the total number of store-and-forward lines to



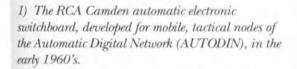


2





2,250 and direct user-to-user lines to 450. Upon completion of the continental US (CONUS) portion of AUTODIN, the system was capable of handling six million messages a month.



- Auto Data Tape Search Unit, developed by RCA Camden for the US Air Force COMLOGNET program.
- 3) The automatic electronic data switching system at Andrews AFB, MD, engineered and produced at RCA Camden, was one of five domestic centers which became operational in February 1963 as part of the US Air Force Data Communications Network (DATACOM). This continental US (CONUS)-based network served 350 military bases and stations across the country as part of the world-wide Automatic Digital Network (AUTODIN). Four additional centers were produced and installed by 1966.
- 4) Typical AUTODIN switching center layout (left) and initial five-node US network, as of 1963.
- 5) Subsystem manufacturing for the AUTODIN program at RCA Camden, September 1966.





6) Supervisor system console, produced for the AUTODIN domestic switching centers by RCA Camden.



- 1) US Army soldiers conducting field tests of the RCA Camden MICROPAC tactical digital computer in 1961. This compact unit, with a packaging density of 150,000 components per cubic foot, was developed for the US Army Micromodule program.
- 2) The MICRORAC random access fieldata computer system, developed for the US Army in 1963, offered a significant automation capability for the modern battlefield. Operating the shelterized, map-plotting portion of the system were RCA Camden engineers, including Dino D'Andrea (foreground).

RCA Camden's Militarized Computer Systems: MICROPAC and MICRORAC

The advances made by RCA Semiconductor in components and circuitry for digital computing afforded many advantages for product packaging. The Surface Communications Department, DEP, Camden began a program to design and develop compact, low-power digital computers for tactical, military applications. In 1961, a general-purpose, militarized computer was developed for the US Army Signal Corps' Micromodule program. The unit, known as "MICROPAC," weighed 130 pounds and was contained in a 2.7 cubic-foot case. It was designed for compatibility with the US Army "Fieldata" family of automatic data processing equipment. At the time, this highlyreliable compact, ruggedized computer was considered a significant achievement in portable tactical data processing.

The success of MICROPAC was followed by the development of "MICRORAC," a larger-scale, random access, militarized digital computer. Designed for use as a battlefield command and control information system, MICRORAC employed over 12,500 micromodules in a single, 22 cubic-foot rack. This shelter-mounted system was developed for the US Army in 1963.



RCA Camden's Portable Military Radio Sets: The AN/PRC-25 and AN/PRC-77

Following successful production of the AN/PRC-8, 9 and 10 family of backpack, tactical, two-way radios for the Korean Conflict, RCA DEP, Camden began development of a new generation of radio sets for the US Army. Work began on solid-state units in 1955. The successful result was the AN/PRC-25 VHF-FM set, the first synthesized, solid-state portable tactical radio. Designed as a lighter-weight (16 pounds without battery) replacement for the AN/PRC-8,9 and 10, the AN/PRC-25 became one of the most reliable and widely-used sets in the US Army.

Production of the AN/PRC-25 began in 1961 at the DEP plant at Cambridge, OH. With the growing involvement of the United States in Vietnam, these sets were deployed for use by both the Army and Marine Corps.





- 1) The AN/PRC-25, the first solid-state, portable military radio set, was designed and built at RCA Camden and served as the communications "work horse" in Vietnam.
- 2) The experimental AN/PRC-51, developed by RCA Camden for the US Army, incorporated micromodule technology for lightweight, helmet-mounted portability. The unit was successfully field tested in 1961-62, but was never produced.
- 3) Army field tests in 1961 of three RCA Camden portable, tactical sets, (l-r): the AN/PRC-51, AN/PRC-25, and the predecessor AN/PRC-10.



1) AN/PRC-25 portable military radio assembly in Building #3, RCA Camden, September 1966.

2) The RCA AN/ PRC-25, providing reliable squad, and platoon tactical communications for US Forces in Vietnam, 1967.





3

The AN/PRC-25 was a 920-channel unit, completely transistorized except for the transmitter power output stage. RCA Camden engineers developed a transistorized replacement for the latter, beginning in 1965. This modification resulted in the development of the AN/PRC-77 set, which was also the first set developed for use with communications security equipment (to encode transmissions for better security).

Following the closure of the Cambridge OH plant in 1965, all AN/PRC-25 and AN/PRC-77 production was consolidated at the Camden, NJ plant. Thousands were produced for US troops in Vietnam, providing continuous reliable communications in combat. RCA eventually produced over 40,000 AN/PRC-25/77 sets. Other companies in the US, Italy and Israel subsequently manufactured additional sets, many of which are still in use today. All told, over 100,000 AN/PRC-25/77 sets were built, making these products two of the biggest success stories in the history of the RCA Camden plant.

- 3) The AN/PRC-77, the all solid-state upgrade to the PRC-25, was developed at RCA Camden in 1965-66.
- 4) Circuit board assembly for the fully-transistorized AN/PRC-77 radio set, Building #3, RCA Camden, September 20, 1967.
- 5) The RCA AN/PRC-77 provided reliable communications in Vietnam from 1967 until the end of the war. Thousands of these rugged sets are still in use today by US and numerous foreign military forces around the world.





1) The AN/ARC-143 airborne radio communications system, developed for the US Navy P-3C aircraft in 1967, was the most successful military airborne UHF radio product in the history of the RCA Camden plant.

Produced for more than 20 years, the AN/ARC-143 is still in use today.

2) The AN/ARC-161, HF counterpart to the AN/ARC-143 UHF set for the US Navy P-3C aircraft, was the most successful military airborne HF communications program in the history of the RCA Camden plant. Since the early 1970's, the AN/ARC-161 has provided continuous. reliable long-haul communications for thousands of missions.

RCA Camden's Airborne Military Radio Sets: AN/ARC-62 to AN/ARC-161

Pioneering in airborne communications at RCA Camden, begun in the early 1930's, resulted in a variety of widely-used systems for the US Government by the end of World War II. In 1949, work began on the AN/ARC-34 UHF receiver/ transmitter, which became the standard command set for the US Air Force. Developments in HF communications during World War II led to the AN/ARC-21 and AN/ARC-65 sets.

Following the organizational realignment of RCA's defense and commercial products busi-



1

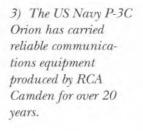


nesses in 1955, the Airborne Systems Department (ASD) of RCA Camden continued development of a series of HF and UHF airborne communications equipment for the US Government.

During the late 1950's, ASD designed and produced the AN/ARC-66 UHF set, a repackaged AN/ARC-34, for the US Air Force F-104 fighter aircraft. The AN/ARC-62 was designed and built as a lighter-weight replacement for the AN/ARC-34.

A series of HF and UHF sets were designed, engineered and produced for the US Navy throughout the 1960's. In 1962, a compact UHF radio repeater, the AN/ARC-97 was developed. This was followed by the AN/ARC-108 emergency transceiver and, in 1967, the AN/ARC-143 set. The AN/ARC-143, built for the US Navy P-3C aircraft, was one of the most successful airborne communications programs in the history of the Camden plant. Production, including spares, continued for over 20 years.

Airborne HF communications, a major endeavor at RCA Camden since World War II, resulted in a continuing series of development and production programs. By the mid-1960's, solidstate circuitry was employed in the lightweight AN/ARC-104 single-sideband HF transceiver, as well as its successor AN/ARC-142. The AN/ ARC-142 was developed for long-haul communications on the US Navy P-3C aircraft. Awarded in 1967, it became the standard for several years. An advanced upgrade, the AN/ARC-161, replaced the AN/ARC-142 in the early 1970's. The AN/ARC-161 HF set, like the AN/ARC-143 UHF set, was one of the most successful airborne communications programs at the RCA Camden plant. Production, including spares, continued for nearly 20 years.





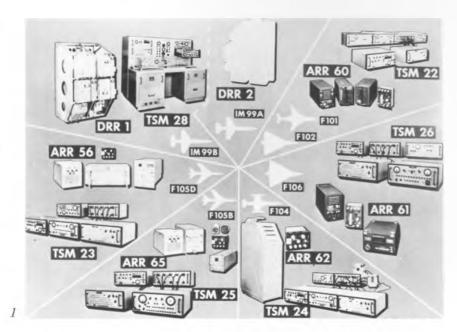
RCA Camden's Airborne Military Data Link Systems: The TDDL Program

Another major product line at RCA's Airborne Systems Department, Camden throughout the 1956-1967 period was airborne and ground equipment for the US Air Force Time Division Data Link (TDDL) program. The TDDL program was part of an air-groundair communications network to provide automatic control of manned and unmanned interceptor aircraft. RCA Camden designed, engineered and produced a series of airborne receivers (designated "DRR" and "ARR") and aerospace ground equipment (designated "TSM") for testing the airborne receivers. The receivers were produced for the F-101, F-102, F-104, F-105B, F-105D, F-106, IM-99A and IM-99B aircraft. All design and development was performed in Building #13, Camden.

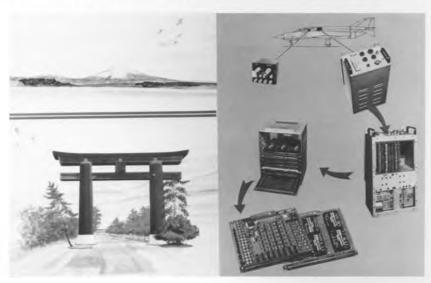
In addition to hardware requirements, RCA, as TDDL System Manager, was responsible for weapon system integration, military liaison, system support and field evaluation.

The ARR-62, built for the F-104, was modified and redesignated the ARR-662. In 1964, a contract was awarded for production of 160 units for the Japanese F-4E fighter aircraft. A second production followed in 1966 for 100 additional units. These 260 units were manufactured in Building #3-2. Production of spares continued through the 1970's.

- 1) The Airborne Systems Department of RCA DEP, Camden produced a variety of airborne receivers and ground support/test equipment for the US Air Force Time Division Data Link (TDDL) program from the late 1950's through the mid-1960's.
- 2) Successful production of Time Division Data Link (TDDL) equipment for the USAF F-104J fighter was followed by a major export sale of similar equipment to Japan in 1964.
- 3) RCA Camden manufactured 260 airborne receivers for the Japanese F-4E fighter aircraft for use as data link equipment. The program began in 1964 and continued through the early 1970's.







RCA Enters the Missile Electronics and Space Age

By the mid-1950's, rapid progress in missile technology created a new role for the electronics industry. Scientists and engineers turned their attention to the business of launching, tracking, guiding and controlling missiles. RCA, as a pioneer in the science, technology, and business of electronics, played an important role in this field. The advent of a new generation of missiles, capable of spanning oceans, created new challenges in upgrading national defense. The development of missiles, capable of penetrating the upper atmosphere, marked the beginning of a new era of space exploration.

RCA's contributions in missile electronics, major defense systems and space exploration were significant. From 1956 to 1960, the corporation experienced major growth in research, manufacturing, and service activities in support of national defense and space programs. Shifting more and more from an entertainment-oriented business to a richly diversified major defense systems business, RCA invested in a major plant expansion at Moorestown, NJ, and added new plants at Burlington, MA; Van Nuys, CA; Riverton and Princeton, NJ. From the launch pads at Cape Canaveral, FL, to the frigid outposts of the Arctic, RCA played a leading role in supporting US national defense and space efforts.

RCA Missile and Surface Radar Department: Formation and Early Programs—TALOS to BMEWS

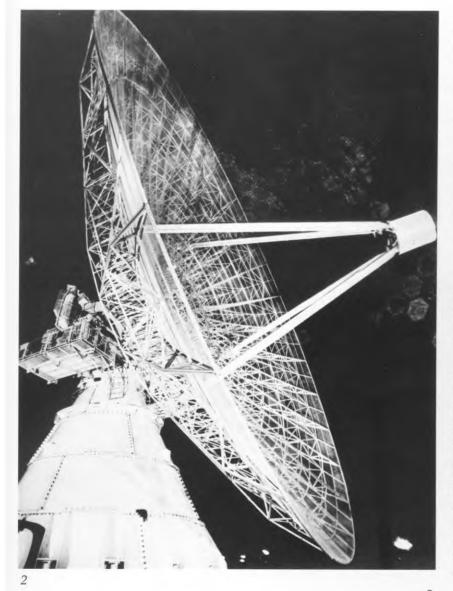
Radar pioneering at RCA, begun in 1932 at the Camden laboratories, led to rapid developments for national defense during World War II. RCA produced fire control radars and radar altimeters for the US Air Force, and manufactured thousands of radars for small vessels for the US Navy. The post-war era saw rapid progress in precision radar indicators and search radars for the Navy.

The advent of the Cold War created the need for a new generation of automated electronics for missile defense. RCA was a key contributor in this field. The Moorestown, NJ engineering plant was opened in December, 1953 to accommodate the expansion of these activities at RCA.

In 1954, the US Navy, in conjunction with the Applied Physics Laboratory of the Johns Hopkins University, established the Talos Defense Unit (TDU) program. Talos was a land-based, surface-to-air missile, under development since the end of the war. RCA Moorestown was selected to develop and build the TDU — the first fully-automatic weapon system for firing and controlling guided missiles. Its role was two-fold: to supply subsystems for a shipboard version for the

- 1) RCA Chairman of the Board David Sarnoff (left) congratulating General Manager Harry Wege on the dedication of the Moorestown, NJ plant as the Missile and Surface Radar Department, May 4, 1956. Courtesy: T.A. Smith.
- 2) The development model of the RCA AN/FPS-49 tracking radar for the Ballistic Missile Early Warning System (BMEWS), erected at the M&SRD plant, Moorestown, NJ, 1959-60. The 84-foot-diameter radar, housed in a 140-foot-diameter honeycombed plastic dome, was a familiar site to passers-by on the NJ Turnpike.
- 3) Gigantic 140-footdiameter plastic dome being erected around an RCA AN/FPS-49 tracking radar at BMEWS site, April 23, 1961.







Navy, and, as prime contractor, to develop and produce a complete, tactical land-based launching and guidance system for the Air Force.

Work on the TDU program was disclosed for the first time by RCA Chairman of the Board David Sarnoff on May 4, 1956. The occasion was the official dedication of the Moorestown plant as the Missile and Surface Radar Department (M&SRD). The plant had just undergone the first phase of a major program of expansion. Over 1500 personnel now worked at the plant, compared to 600 in 1953. Total building space had grown from 145,000 square feet in 1953 to 264,000 square feet with the 1956 expansion.

The first TDU was delivered to the Army for testing on October 15, 1957. It was successfully fired at the White Sands, NM Proving Grounds on December 13. So successful was this program, that RCA M&SRD received the Navy Award of Merit on June 17, 1958.

That same year, RCA M&SRD received one of the largest contracts ever awarded by the US Department of Defense — project management for the Ballistic Missile Early Warning System (BMEWS). This contract encompassed the complete systems responsibility for the program, to include systems concept; systems design; hardware design, production and test; site installation, integration and test of all equipment; logistic support, and site maintenance and operation. As manager of this tremendous undertaking, M&SRD had 485 major subcontractors, and 2,415 smaller firms located in 29 states under contract.

Designed to protect the Free World from a surprise ballistic missile attack via the Arctic, BMEWS consisted of three sites: Thule, Greenland; Clear, Alaska; and Fylingdale's Moor, Yorkshire, England. By fall 1961, the Thule and Clear sites were complete and operational. More than 1,000 RCA employees, most from the Service Company, were on-site for construction and operation at each location. The Fylingdale's Moor site was finished the following year.

In addition to integrating the entire system, RCA M&SRD also developed and produced the AN/FPS-49 tracking radar. Eighty-four feet in diameter, the radar was enclosed in a honeycombed plastic dome, 140 feet in diameter. In addition to the units produced for the sites, another AN/FPS-49 was erected at the Moorestown, NJ plant for testing purposes. The "golf ball" became a familiar site to thousands of travelers on the New Jersey Turnpike.

General Electric Company supplied the massive AN/FPS-50 detection radar, under subcontract to RCA, for the Thule and Clear sites. These GE units were designed to withstand winds of up to 185 miles per hour even when covered with six inches of ice.

BMEWS was one of the largest single electronic complexes ever assembled. The Thule site, for example, contained 290 electronic equipment cabinets, 10 monitoring consoles, 8 high-speed scanning switches, 440 miles of connecting cable and waveguides; 315,000 transistors; 33,000 vacuum tubes; 270,000 capacitors; and 1,000,000 resistors.

Training the user teams from the North American Air Defense Command (NORAD) was the responsibility of the RCA Service Company, which it carried out at Colorado Springs, CO; Moorestown, NJ; and at a newlyestablished company plant at Riverton, NJ.

The engineers at RCA Camden also contributed to the BMEWS program, through the design, development, and production of custom magnetic recorders.

The \$723 million BMEWS program was completed in 1963, achieving operational capability on schedule, under budget, and with no deviations in performance. The success of BMEWS marked the start of a long and rich history in major land and sea-based radar and weapons systems programs by the RCA Moorestown plant for the US Government.

- 1) Completed BMEWS site, showing four GE AN/FPS-50 detection radars and an RCA AN/ FPS-49 tracking radar ("golfball"), May 25, 1961.
- 2) RCA technician inspecting the massive AN/FPS-50 detection radar at the BMEWS site at Thule, Greenland, 1961. The AN/FPS-50, supplied by GE under subcontract to RCA, was designed to withstand winds of up to 185 mph, even with a six-inch covering of ice.
- 3) The RCA Service Company established a new facility at Riverton, NJ in 1960 to serve as its headquarters for the BMEWS program. In addition to its use as a training facility for military users, the Riverton operation supplied the USAF Logistics Support Center at Griffiss AFB, Rome, NY with spare parts for all BMEWS sites.







RCA M&SRD Expansion: Formation of the West Coast Electronics Center, Van Nuys, CA

The Missile and Surface Radar Department's activities increased significantly between 1956 and 1959, requiring further expansion and organizational realignment. A new West Coast Electronics Center was constructed at Van Nuys, CA to supplement activities at both the M&SRD plant at Moorestown, NJ and the West Coast plant of the Airborne Systems Department at Los Angeles, CA. Dedicated on April 6, 1960, the Van Nuys plant was described as the nation's most advanced facility for the engineering and production of ballistic missile checkout, guidance, and control systems. The Van Nuys operation began production of automatic checkout and launch control systems for the Atlas Intercontinental Ballistic Missile (ICBM) and the launch-control automatic pilot for the Thor Intermediate Range Ballistic Missile (IRBM) as major programs in 1960. Other programs started at Van Nuys included longrange radar navigation (LORAN) instruments, weather radar for the US Air Force and Navy, electronic countermeasures equipment, and subsystems for the BMEWS program.

An organizational realignment of RCA radar activities occurred in April 1961. The Los Angeles and Van Nuys plants were combined to form the West Coast Missile and Surface Radar Division. The Moorestown plant was realigned to form two divisions. The Missile and Surface Radar Department became a division, and the activities on BMEWS were consolidated under the newly-created Major Defense Systems Division. A. N. Curtiss became general manager of the West Coast Division, and S. N. Lev became general manager of the M&SR Division. The Major Defense Systems Division was run by J. H. Sidebottom. H. R. Wege was promoted to Vice-President and General Manager, Missile and Surface Radar, in charge of all three divisions.

The Data Systems Division at the Van Nuys plant supported RCA's computer business activities through production of mass memories for the RCA 3488 and Spectra 70 systems. Another major contribution by the West Coast operation was the development and production of the ground-based computer checkout system for the Saturn V rocket, used to launch Apollo astronauts to the moon.





- 1) The RCA West Coast Electronics Center, dedicated on April 6, 1960, was established to produce the automatic checkout and launch control systems for the Atlas ICBM. RCA M&SRD won the program, setting up a west coast manufacturing facility to provide closer coordination with missile-building companies.
- 2) RCA recruited some of the finest space electronics engineers for the West Coast Electronics Center at Van Nuys, CA. Of the 1,800 employees, over 400 were engineers. Their combined experience exceeded 4,000 man-years.

RCA Missile Electronics and Controls Department, Burlington, MA: Formation and Early Programs

The new emphasis on missile electronics required development of compact, lightweight, rugged equipment. Employing micromodule and semiconductor technology, RCA made significant advances in systems packaging and reliability.

To further expand this business, two new operating units were set up in 1958. One was the Advanced Military Systems organization at Princeton, NJ, which performed studies for development of advanced weapons systems. The other was the Missile Electronics and Controls Department (MECD), headquartered at Burlington, MA, to research, develop and produce electronic equipment for missiles and space vehicles.

The Burlington operation was an outgrowth of the Aviation Systems Laboratory, which was established on March 7, 1955, at Waltham, MA, to develop specialized fire control systems for military aircraft. The Laboratory attracted young engineers from MIT and other academic institutions in the New England area to perform advanced research in this field. By 1958, this expanded operation required more space. A new plant was erected at Burlington, MA and dedicated on October 22, 1958. W. B. Kirkpatrick became the first General Manager.

The first projects conducted at the new plant were the development of inertial guidance systems and an advanced spaceborne system known as SAINT (Satellite Inspector). During its first five years, MECD also investigated advanced technologies in electro-optics, lasers for ranging

applications, and miniaturized computers.

In April 1961, the operations of the Airborne Systems Division, Camden, NJ were merged with MECD's efforts at the Burlington's plant, and a new division, known as Aerospace Communications and Controls Division (ACCD), was formed. By the following year, many Camden engineers transferred to the Burlington plant. In 1963, ACCD was merged with the Data Systems Division, Van Nuys, CA to form the Aerospace Systems Division (ASD). From 1963 to 1968, ASD, Burlington expanded its product line to include automatic test equipment and command, control, communications and intelligence systems. Major programs during this period included Multi-Purpose Test Equipment (MTE) for the US Army Signal Corps and Depot Installed Multi-Purpose Automated Test Equipment (DIMATE) at Tobyhanna, PA. The DIMATE program, and the follow-on Land Combat Support System (LCSS) program, established RCA ASD, Burlington as a recognized leader in automated test systems, solidifying its position with the US Army Missile Command at Huntsville, AL.

The Burlington operation also began intense research in advanced airborne radar for space applications. This group was already deeply involved in the development of advanced assemblies for the Apollo Lunar Excursion Module (LEM) program by the mid-1960's. The development of the Rendezvous Radar, Attitude and Translation Control Assembly (ATCA) and Descent Engine Control Assembly (DECA) would become critical equipment on all Apollo space missions, beginning in 1968.

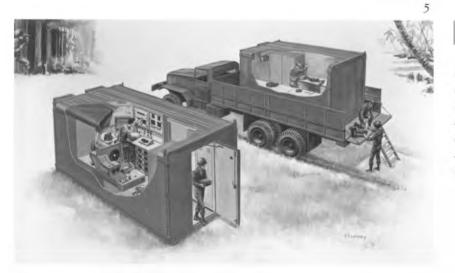
- 1) The RCA Missile Electronics and Controls Department (MECD) was established at a new plant in Burlington, MA in 1958 for research, development and production of advanced electronic equipment for missile and space programs.
- 2) RCA President John L. Burns (left) and Robert Seamans, Jr., chief engineer, unveil the plaque dedicating the new Burlington, MA engineering plant as the Missile Electronics and Controls Department, October 22, 1958. Courtesy: GE Automated Systems.
- 3) Massachusetts Governor Foster M. Furcolo cutting the ribbon to officially open the Burlington plant, with RCA President John L. Burns at his side, October 22, 1958. Courtesy: GE Automated Systems.
- 4) A highlight of the October 22, 1958 dedication ceremonies for the RCA Burlington, MA plant was a special appearance by Boston Pops Conductor Arthur Fiedler, leading the local Tewksbury High School Band. Courtesy: GE Automated Systems.











5) Expanding beyond its initial efforts in missile and space electronics, the RCA Burlington plant became a recognized leader in automated test systems by the mid-1960's. The Land Combat Support System (LCSS) was one of several major successful programs for the US Army. Courtesy: GE Automated Systems.

RCA Astro-Electronic Products: Formation and Early Pioneering Achievements in Space

On October 4, 1957, the first signals from a man-made satellite in outer space were heard around the world. The Soviets had successfully launched the 184-pound "Sputnik I," marking the beginning of the Space Age.

The United States reacted quickly, establishing the National Aeronautics and Space Administration (NASA) in 1958 to plan, coordinate, and execute space programs.

That same year, RCA established a special division, Astro-Electronic Products (AEP), to emphasize its commitment to the US space program. A new center was constructed near Princeton, NJ, a few miles from RCA Laboratories' David Sarnoff Research Center. A core engineering team from the Laboratories transferred to AEP and commenced work to develop systems that would assist the US Government in establishing an extensive program in space.

On December 18, 1958, an Atlas missile, carrying a recorded Christmas message of peace from President Dwight D. Eisenhower, was placed into orbit. RCA communications

equipment, built for the US Army Signal Corps, carried this first voice message to earth. This was Project SCORE (Signal Communications by Orbiting Relay Equipment). Relaying voice, code, and teletype messages, SCORE proved the feasibility of active-repeater communications satellites.

RCA's work in satellites actually dated back to 1951, when it began a study of television satellite techniques. That early work culminated in a 1958 meeting between US Government, university, and RCA personnel to focus on development of a meteorological satellite. Within two years, the concept became a reality.

On April 1, 1960, the world's first meteorological observation satellite, produced by RCA AEP, was successfully launched by NASA. Known as TIROS I (Television Infrared Observation Satellite), the satellite produced continuous weather pictures to aid meteorologists in forecasting global and local weather conditions. TIROS II, launched on November 23, 1960, carried the first infrared sensor into space. TIROS III, launched on July 12, 1961, sent the first automatic TV picture

1) In 1958, the United States officially entered the Space Age with the establishment of the National Aeronautics and Space Administration (NASA). That same year, RCA organized Astro-Electronic Products as a special division to design, develop and manufacture spacecraft and systems for space exploration. This new facility was constructed near Princeton, NJ to serve as its headquarters. It was opened only five months after the "Sputnik I" launch by the USSR.



transmissions from space. By 1965, RCA Astro-Electronics, as prime contractor, had designed, built, tested and delivered 10 TIROS satellites and four ground stations.

NASA's Nimbus I experimental weather satellite carried an RCA Astro-Electronics new high-resolution TV cloud-mapping system, called the Advanced Vidicon Camera System (AVCS), and an Automatic Picture Transmission System (APT), that allowed direct transmission of weather pictures to local weather stations. The successful experiments on the Nimbus I program led to the use of the AVCS and APT systems on the TIROS Operational System (TOS) Satellites.

RCA Astro-Electronics designed and built nine TIROS Operational System (TOS) satellites under NASA technical direction for the Department of Commerce's Environmental Science Services Administration (ESSA). These spacecraft, renamed ESSA satellites, were launched between 1966 and 1968. ESSA 1 and 2, launched in February 1966, provided the world's first global weather system to go into routine operation. All ESSA satellites outperformed mission life requirements. ESSA 8 completed over seven years of operational service before being deactivated.

- 2) TIROS I, the world's first weather satellite, being positioned for an outdoor test of its solar power cells at RCA Astro-Electronics Division, Princeton, NJ, early 1960. The first of many successful weather satellites produced by RCA for NASA, TIROS I carried the first television camera and video recorders into space when it was successfully launched on April 1, 1960. During 1,300 earth orbits, TIROS I returned 23,000 useful cloud pictures to earth.
- 3) RCA engineer Ralph Jordan (left) and Chief Engineer Sidney Sternberg of RCA Astro-Electronics Division, aligning a TV camera on the TIROS II weather satellite, early 1960. Launched by NASA on November 23, 1960, TIROS II carried the first infrared equipment for measuring heat balance in the earth's atmosphere.





Another early success story at RCA Astro-Electronics was the Relay communications satellite. Relay I, launched December 13, 1962, was NASA's first active repeater satellite. It established a record of more than 2,000 successful operations in its first year, including 290 hours of intercontinental television broadcasts. Relay I was, in fact, the first satellite to handle trans-atlantic television transmissions. Among the memorable international broadcast events carried by Relay I were the assassination of President John F. Kennedy, the actual shooting of suspect Lee Harvey Oswald, and the President's funeral. These telecasts were beamed by Relay to 200 million viewers in Europe, the Soviet Union and Japan. Other outstanding events in Relay I's life included the first satellite-relayed telephone conversations between the US and West Germany; the first trans-pacific TV transmissions from the US to Japan; transmission of electroencephalograms (brain waves) from England to the US for surgeon's diagnosis, with results interpreted and transmitted back; and transmission from Camden, NJ of computerized data to automatically set type in newspapers in England and Scotland.

Relay II was launched on January 21, 1964. Collectively, the two Relay spacecraft established a standard of reliability and long life. In over five years of operation, they carried out some 5,000 television, voice, teletype and facsimile experiments and demonstrations.

RCA Astro-Electronics also designed, built and tested the first space vehicle for testing ion engines. The one-hour flight on July 20, 1964, known as SERT (Space Electric Rocket Test) was so successful, that a second scheduled NASA test was cancelled.

Astro-Electronics also made significant contributions to the Ranger lunar probe program. The division provided an advanced television system which transmitted the first high-resolution pictures of the surface of the moon aboard Ranger VII in July 1964. These first successful deep-space television transmissions had a picture resolution 2,000 times better than any earth telescope. Ranger VII was completely successful, producing 4,316 photos. Subsequent successes of Ranger VIII and IX in February-March 1965 produced an additional 7,160 and 5,800 photos, respectively. In all, RCA Astro's advanced television equipment on Ranger missions produced over 17,000 photos of the moon, enabling scientists to observe details never before seen.

Beginning in 1964, RCA Astro-Electronics developed power and TV systems as a subcontractor to the Boeing Company for all five Lunar Orbiters. From August 1966 until August 1967, these five spacecraft successfully transmitted over 1,600 photos of the moon's surface, allowing NASA officials to select preferred landing areas for the upcoming Apollo missions. Astro-Electronics also built special ground support equipment and assisted Boeing in the design, engineering and environmental testing of the spacecraft.

These early pioneering achievements and contributions established RCA Astro-Electronics as a world-wide leader in the design, development, production and operation of spacecraft systems, subsystems, and associated ground equipment.





1) Among the memorable events covered by the Relay I communications satellite was the April 1963 White House ceremony proclaiming Sir Winston Churchill an honorary citizen of the United States. As Sir Winston watched from his London home, courtesy of Relay I, his son Randolph read the British leader's prepared statement to an audience of 250 gathered in the White House gardens and the world. This remarkably clear image of President Kennedy and Randolph Churchill was an actual, unretouched picture as seen by viewers on both sides of the Atlantic. Courtesy: Edy Mozzi, GE GCSD.

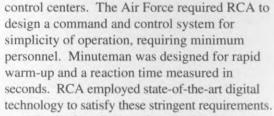
2) Max Gittler (left) mechanical integration and assembly engineer, and Dick Dunphy, project manager, RCA Astro-Electronics Division, testing the Relay II communications satellite in 1963. Relay II, launched January 21, 1964, followed the success of Relay I, NASA's first active repeater satellite. Together, Relay I and II operated for over five years and carried out over 5,000 television, voice, teletype and facsimile experiments and demonstrations. Courtesy: GE Astro-Space.

1) Launch Control Center (LCC) for the US Air Force Minuteman ICBM, equipped with state-of-the-art command, control and communications systems designed and produced by RCA Surface Communications, Camden, NJ, New York, NY and Cambridge, OH.

RCA Surface Communications Department: The Minuteman Program

By the late 1950's, the US Air Force was involved in development of a new second-generation ballistic missile—the Minuteman ICBM. RCA was selected to design, develop and produce high-reliability command, control and communications equipment for the Minuteman program. Responsibilities included both the Sensitive Command Network (SCN) and the Support Information Network (SIN).

The Minuteman missile was stored underground, which presented unique challenges for RCA in designing communications equipment for placement in the silos and remotely-located



The Surface Communications Department (SCD) of RCA Defense Electronic Products. headquartered at Camden, NJ, was responsible for the program. Initial design studies were performed by RCA engineers at Camden and at the SCD laboratory on Varick Street, New York City. Production began at the SCD Cambridge, OH plant in 1961, which had converted operations from consumer electronics to defense electronics programs. An 80,000 square-foot "white room," the largest in the Free World, was added to the Cambridge plant for production of the sensitive electronic subsystems for Minuteman. Unprecedented component manufacturing and test procedures, using computer-aided analysis, were followed. As a result, RCA produced the most reliable components possible at that time. Production continued at Cambridge until 1965, when the plant was closed. Remaining production was accomplished at the Camden plant, where the white room was moved to Building #3.

The successful completion of the highlycomplex command, control and communications systems for the Minuteman program greatly enhanced RCA Camden's reputation as a major communications systems engineering and production organization.





2) Production of specialized electronic subsystems in the Building #3 white room, RCA Camden, for the USAF Minuteman Sensitive Command Network, 1965.

RCA Defense Electronic Products and the Dyna Soar Program

In January 1958, the US Air Force and NASA invited the defense electronics industry to submit proposals on a hypersonic weapon system which would launch a piloted glider into nearorbital flight. The system was to be called Dyna Soar (short for Dynamic Soaring). The basic concept was not unlike the present-day National Aerospace Plane program. The Boeing Airplane Company was selected to design and build the glider. Boeing selected RCA to study the problems of high-resolution bombing, navigation and reconnaissance radar in 1958. RCA's Missile Electronics and Controls Department, Burlington, MA was responsible for the majority of research and development in these technologies, supported by the Missile and Surface Radar Department, Moorestown, NJ for ground-based tracking radar. In March 1959, Boeing further selected RCA to perform a quick-reaction study for a complete, integrated communications system for Dyna Soar. The Surface Communications Department, Camden, NJ performed the study, which addressed ground-air-ground and point-topoint communications requirements.

In December 1960, RCA Camden was awarded a contract to design, develop and produce the Communications and Data Link (CADL) subsystem for the Dyna Soar system. The CADL subsystem included voice communications (air-ground-air), flight safety communications (air-ground-air), vehicle tracking (air-ground), a command data link (ground-air), glider range safety communications (ground-air), and scientific data telemetry (air-ground).

Initial development of these subsystems was accomplished at RCA Camden. Other major responsibilities on the program included the design of the 12-foot communications acquisition and tracking antennas; airborne data recording equipment; airborne system calibration, control and monitoring equipment; and complete design and integration of the glider electronic system, including antennas, recording, communications and telemetry equipment.

The Dyna Soar program was subsequently cancelled by the Government due to funding constraints. Even though the program never reached full-scale production, RCA Camden benefited from the development of a hand-held UHF search-and-rescue transceiver, which became the basis for portable communications devices for NASA's manned space programs.





- 1) The Dyna Soar program, a joint US Air Force/NASA effort to launch a piloted glider into near-orbital flight, was started in 1958. RCA Camden developed the communications and data link (CADL) subsystems as an associate contractor, beginning in December 1960. Due to funding constraints, the program was cancelled prior to production. Camden engineers, however, gained valuable experience in space-based communications through this program, which was applied to subsequent NASA projects.
- 2) A successful result of RCA Camden's work on the Dyna Soar program was the development of a handheld UHF search and rescue transceiver, which became the basis for follow-on portable communications for NASA's manned space programs.

RCA Camden: Pioneer in Recording and Communications Systems for the US Space Program

With the advent of the Space Age, the pioneers of RCA Camden applied their talents and experience in communications and recording systems to produce many important systems for the US space program.

Beginning in 1959, with the first wideband magnetic tape recorder for space, RCA Camden's Magnetic Recording Department made numerous contributions to manned and unmanned space programs for NASA and the US Department of Defense. Between 1960 and 1966, RCA video recorders were used on all 11 TIROS weather satellites (two recorders per mission) without a failure. Infrared recorders were carried on the Nimbus I (1964) and Nimbus II (1966) weather satellites. Five ESSA (Environmental Science Service Administration) weather satellites carried reliable RCA Camden recorders between 1965 and 1968. From 1964 to 1968, 18 digital recorders were built for NASA's Orbiting Geophysical Observatory (OGO) program. Twelve of these operated successfully on six OGO spacecraft. One OGO recorder established a longevity record of 26,000 operating hours in space.







- 1) RCA Camden video recorders were used on all 11 TIROS weather satellites between 1960 and 1966 without a failure.
- 2) The Advanced Vidicon Camera System (AVCS) recorder, one of the most versatile and reliable recorders ever produced by RCA, was used on the NASA Nimbus I (1964) and Nimbus II (1966) experimental weather satellites. The AVCS recorder featured a revolutionary doublewrap capstan tape path and high-speed start mechanism which became standard in coaxial recorders. The AVCS was the predecessor to recorders used on the Orbiting Geophysical Observatory (OGO), Orbiting Astronomical Observatory (OAO), and Environmental Science Service Administration (ESSA) weather satellites between 1964 and 1969.
- 3) Al Katz, magnetic recording engineer, assembling a Gemini recorder in the RCA Camden" white room," Building #10, 1963. These recorders stored telemetry data continuously for four hours and played it back in only 11 minutes.

- 1) RCA Camden recorders were aboard all 10 successful NASA Gemini capsules, from Gemini 3 in 1965 to Gemini 12 in 1966.
- 2) Physicist Richard J. Tarzaiski of RCA's Applied Research Activity, Camden, NJ, with his experimental "Sun-Pumped" Laser, August 16, 1965. The laser, powered by the sun's rays collected in the parabolic mirror, was developed for NASA's manned spacecraft center, Houston, TX. Thus was the first step in a 50-million-mile communications link between earth and spacecraft near Mars. The device was the first to transmit TV pictures over a light beam from a sunlight-powered laser.



1





Space recorders/reproducers for the US manned space program began with Project Gemini. Miniature digital recorders were flown on all 10 successful Gemini missions between 1965 and 1966. Operated during launch, orbit and reentry phases, these recorders stored telemetry data continuously for four hours and played it back in only 11 minutes.

These were just some of the numerous achievements of RCA's Magnetic Recording Department, Camden, NJ through 1967. In addition to spaceborne recorders, this group produced radar recorders for US Navy surface vessels and submarines, portable video recorders for mobile applications, airborne radar recorders for high-performance military aircraft, tape loop recorders for US Army missile launch locator systems, tactical tape cartridge recorders/reproducers for automatic checkout ground computers used for Army missile programs and magnetic drum storage systems for other US Government programs.

The Magnetic Recording Department, part of the Surface Communications Division at Camden, was supported by research groups at RCA DEP's Applied Research Activity, colocated at Camden and the Astro-Electronics Division, Princeton, NJ. Additional research support came from RCA Laboratories.

RCA Camden also made several significant contributions in space communications to various NASA projects during this period. In addition to the Gemini recorder/reproducer, the Surface Communications Division (SCD) provided the Gemini telemetry transmitter. This solid-state, two-watt unit measured only 40 cubic inches and weighed 41 ounces. Three were carried in each Gemini capsule—two active and one spare. The first three units were shipped in January 1963. By 1965, 80 models were produced and delivered. A total of 600 hours of reliable space communications were logged on these transmitters, with no failures.

A beacon and telemetry transmitter was also produced for the RCA-designed and produced Relay communications satellite. RCA Camden also manufactured solid-state telemetry transmitters for NASA's Space Tracking and Data Acquisition Network (STADAN) and for US Air Force programs.

The Ranger VII spacecraft, which made the first successful deep space television transmissions of the lunar surface, carried RCA Camden-produced telecommunications equipment. The equipment included FM modulators, multiplexers, transmitters, power amplifiers and telemetry processors. RCA Camden also

provided the ground communications subsystem for Ranger VII, which included telemetry simulators, tape demodulators, test transmitters, telemetry and tape recorders, receivers and custom control and interface equipment.

Although the first Apollo moon landing did not occur until 1969, engineers at RCA Camden were busy developing communications subsystems for the Lunar Excursion Module (LEM) since 1963. As a subcontractor to Grumman, the SCD was responsible for overall subsystem integration, as well as design and development, of the VHF transceiver. Prototypes were produced and delivered for tests between 1965 and 1967, and the first manned flight, Apollo 7, carried the first production systems in October 1968.



- 3) This lightweight (41-ounce), compact (40-cubic-inch) telemetry transmitter, produced by RCA Camden for Project Gemini, provided over 600 hours of reliable service without failure. Eighty units were manufactured and delivered to NASA by 1965.
- 4) In 1964, RCA
 Communications Systems
 Division (formerly
 Surface Communications Division) had
 achieved another milestone in communications pioneering, when
 its spaceborne telecommunications and support
 equipment aboard
 NASA's Ranger VII
 allowed the transmissions
 of the first live deep-space
 photos of the moon.



Realignment of RCA's DEP Divisions at Camden, NJ; Burlington, MA and Van Nuys, CA (1963)

In October 1963, RCA Defense Electronic Products (DEP) divisions at Camden, NJ; Burlington, MA; and Van Nuys, CA were realigned to allow closer coordination of related communications programs.

The changes affected the Data Systems Division (DSD), Van Nuys; the Surface Communications Division (SCD), Camden; and the Aerospace Communications and Controls Division (ACCD), Camden and Burlington.

DSD was merged with ACCD, to form the Aerospace Systems Division (ASD), with headquarters at Burlington. Irving K. Kessler, formerly vice-president and general manager of ACCD, remained in that position in the new division.

The communications portion of ACCD, which was based at Camden, was merged with the SCD, Camden, to form the Communications Systems Division (CSD). Stanley W. Cochran, formerly vice-president and general manager of the SCD, kept the same post in the new division.

These changes were brought about, in large part, from RCA's expanding business in the US space program.

RCA's Commercial Electronic Products: Expansion to Meadow Lands, PA and Gibbsboro, NJ

While defense and space electronics activities at RCA, Camden continued to grow, commercial electronics activities at RCA Camden were realigned to focus on growth markets in broadcast and communications.

In early 1957, RCA Commercial Electronic Products, headquartered at Camden NJ, consisted of four departments: Theatre and Industrial Products, Communications Products, Broadcast and Television Equipment, and Commercial Production. Over the next four years, a number of changes were made involving the relocation and refocusing of these departments.

Theatre sound system production was phased out at Camden, while certain industrial products remained. Electron microscope production continued, achieving a milestone in 1962 when the 1000th unit rolled off the assembly line.

Microwave equipment production was also phased out at Camden, while two-way mobile radio communications and audio-visual equipment engineering and production were transferred to a new RCA plant at Meadow Lands, PA in 1961. Located some 30 miles southwest of Pittsburgh, the Meadow Lands plant also carried a special product line which included industrial audio amplifiers, Citizen's Band (CB) radios and test equipment, and inter-office communications systems. Broadcast transmitter production,







- 1) RCA's new engineering and manufacturing center at Meadow Lands, PA, opened in July 1961, became home to a variety of commercial communications product lines transferred from the Camden plant. Broadcast transmitters, mobile communications and audio-visual equipment were all produced here.
- 2) An RCA two-way mobile radio being packed for shipment at the Meadow Lands, PA plant in 1965.
- 3) To provide a larger and more modern home for RCA Camden's broadcast antenna assembly and test operations, the company purchased 130 acres of land in Gibbsboro, NJ in 1954 and built a new facility here in 1957. Continually expanded over the years, the Gibbsboro test facility was the largest of its kind in the world. This aerial view shows the facility in the 1980's.

which had been carried out in the aging Building #53, State Street and River Road, Camden, was also transferred to the Meadow Lands plant. This new facility also produced television camera cables and microwave system components for Camden's Broadcast Systems Division, certain commercial radio and radar units for RCA Radiomarine, and printed-circuit boards for the RCA 501 and 301 computers.

The broadcast antenna assembly operation, which had also been housed in Building #53, Camden, was transferred to a newly-constructed facility in Gibbsboro, NJ by the late 1950's.

RCA Broadcast Systems: Color TV Tape Recorder and Camera Developments at RCA Camden

The period 1959-1967 was marked by several new broadcast product developments at RCA Camden. Research in television video tape recorders for studio use had begun in the early 1950's. RCA demonstrated the industry's first color TV tape recorder in 1953. The unit, using a single-head, longitudinal recording format and 1inch-wide tape, was field tested by NBC the following year. However, since this prototype had technical shortfalls of high tape consumption and low recording capacity, it was not ready for the market. In the meantime, the Ampex Corporation introduced a new monochrome TV tape recorder in 1956 to an industry hungry for any recording capability. Called the VR-1000, the Ampex unit employed a quadruplexed recording format and 2-inch-wide tape. It was the only TV tape recorder available to the industry until 1959. when RCA introduced the first color quadruplextype recorder—the TRT-1A.

In 1959, Charles Colledge, formerly vicepresident for operations at NBC, became general manager of the Broadcast Equipment Division, Camden. He approved a plan developed by the engineers in Building #17 for a revolutionary all solid-state recorder. Under the leadership of Tony Lind, assisted by Arch Luther, a prototype was developed and first demonstrated at the 1961 National Association of Broadcasters (NAB) convention. Called the TR-22, it was met by an enthusiastic response from the industry. In addition to being all transistorized, the TR-22 incorporated a stylish design. For the next two years, the TR-22 dominated the industrial television videotape recorder market. RCA further applied transistor technology to a new product line of recorders, which included the TR-4 vertically-mounted transport unit, the TR-3







4) RCA's first color TV magnetic tape recorder, demonstrated in 1953 by William Houghton (left) and Dr. Harry Olson, opened a new era in "electronic photography."

5) E.C. Tracy (left) and C.H. Colledge, RCA Broadcast and Television Equipment Division, and the TRT-1A televison tape recorder. RCA Camden responded to the Ampex VR-1000 monochrome system with the TRT-1A, first color recorder, which was first demonstrated at the 1958 NAB convention. Unlike the VR-1000, which used a combination of rack and console mounting, the TRT-IA was all rackmounted. This was the first successfullymarketed RCA TV tape recorder, which was first sold in 1959.

6) The revolutionary TR-22, the first all solid-state studio color television video-tape recorder, became an immediate hit upon its unveiling at the 1961 NAB convention. For the next three years, the TR-22 dominated the market. Its stylish design featured the first angle-mounted tape reels.





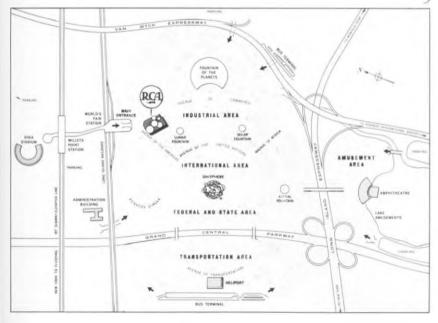
playback-only version of the TR-4, and the TR-5 compact transportable field unit.

In 1965, Ampex introduced the VR-2000, a high-band color videotape recorder, which offered greater picture quality than both the VR-1000 and RCA's TR-22 low-band recorders. The

- 1) RCA TK-60, the 4 1/2-inch Image Orthicon commercial monochrome TV "camera of the 60's," was the last black-and-white model marketed by the corporation. It was introduced in 1962, but few were sold due to the strong growth in color broadcasting.
- 2) RCA Camden's Broadcast Systems Division introduced this first wave of "New Look" products at the 1964 NAB Convention. This new line was easily recognized by the blue-colored cabinets, which replaced previous gray-colored units. Pictured clockwise from top center are the: TK-27 color film camera for the telecine system, TFR-1 TV film recorder for making kinescope films, TR-22 TV tape recorder, TP-66 16-mm movie projector (with TK-22 monochrome camera attached), TR-3 TV tape playback-only system, TR-5 transportable TV tape recorder, TR-4 vertical transport TV tape recorder, TK-60 monochrome studio camera, and BC-7 broadcast audio console. Pictured at bottom left are: the BTF-20 FM radio transmitter (single cabinet) and a TV transmitter (3 cabinets joined). RCA at this time, was the only full-line broadcast equipment supplier in the world. Courtesy: Lytle Hoover, GE GESD.
- 3) RCA Camden's Broadcast Systems Division designed and produced this 50-pound, portable television system for NBC's coverage of the 1964 Democratic National Convention.
- 4) Visitors to the 1964-65 New York World's Fair received an exciting and colorful welcome by the RCA Exhibit as they entered the main gate. Fairgoers were able to watch the production of TV programs in a complete color broadcasting facility; listen to stereo recordings in special lounges; watch closed-circuit color TV on sets located throughout the Fair, and keep informed of Fair happenings via loudspeakers all courtesy of RCA.
- 5) The RCA Exhibit at the 1964-65 New York World's Fair was prominently located to receive the millions of visitors arriving through the main entrance.







VR-2000 quickly overtook the TR-22 on the market, beginning in 1965. The Broadcast and Communications Products Division at Camden once again met the competition with the TR-70 high-band color videotape recorder in 1966.

RCA's Broadcast Systems Division introduced a number of monochrome and color television cameras between 1959 and 1964. The TK-12 monochrome camera, incorporating a 4 1/2-inch image orthicon tube, debuted in 1959. This was the first RCA broadcast product to incorporate a new stylish design which became known as the "RCA New Look" in 1961. All RCA broadcast products shown at the 1961 National Association of Broadcasters (NAB) Convention were of the "New Look" design, packaged in new blue-colored cabinets in place of traditional gray.

The improved design TK-60 studio camera (named for "the camera of the 60's") superceded the TK-12 as RCA's monochrome camera. Although it was a superior product, the TK-60 did not sell well in the commercial TV industry, which was shifting to color broadcasting in the early 1960's. The TK-60 was the last RCA monochrome TV camera produced.

The 4 1/2-inch image orthicon tube used in the TK-12 and TK-60 was incorporated into RCA's next generation color studio camera, the TK-42. First demonstrated in 1964, the TK-42 employed some solid-state circuitry, an internally-mounted zoom lens and a fourth pickup tube for improved color resolution. Although larger and heavier than its predecessor TK-41 color unit, the TK-42's improved picture quality made it a popular seller. Together with its successor TK-43, which used an external zoom lens, some 500 units were sold from 1965 to 1969.

The Broadcast Division also designed and built a customized man-portable television system for NBC's use at the 1964 Democratic National Convention. Designated the UPV-1 Ultra Portable Television System, it contained a handheld vidicon camera, a backpack microwave transmitter and antenna, a harness-mounted monitor, and a one-hour battery pack. The entire system weighed about 50 pounds. It was, at the time, the latest advance in man-portable news coverage.

These and other new broadcast products were demonstrated to millions of visitors to the RCA exhibit at the 1964-65 New York World's Fair. The age of color broadcasting had arrived by this time, and RCA was finally beginning to reap the benefits of its many years of investment in color television products.

RCA and the Zero Defects Program

In October 1964, four operating divisions of RCA Defense Electronic Products (Communications Systems Division, Camden, NJ; Missile and Surface Radar Division, Moorestown, NJ; Astro-Electronics Division, Princeton, NJ; and Aerospace Systems Division, Burlington, MA), as well as some of the corporation's consumer-oriented businesses, entered into a major program to eliminate defects in the workplace.

Known as the "Zero Defects" program, it involved a system of recognition and awards for substantial improvements across the total work force. The goal was to improve the quality of all operations, resulting in higher cost and schedule efficiency, from administration to manufacturing.

The program was managed by an executive-level committee, which provided policy guidance and coordination support to the divisions. Each division, however, was given autonomy in formulating and executing its own particular program. A "Zero Defects Olympic Decathalon" was set up in early 1965 to instill competition among the four participating defense divisions. Each month, the top-performing division was awarded the Arthur L. Malcarney trophy, named for the Group Executive Vice-President who spearheaded many suggestion and process

improvement programs throughout his career.

The initial program was very successful, resulting in significant improvements in cost, schedule and product quality. The second phase concentrated on specific groups within the total work force, especially: secretarial and clerical, engineering, drafting and documentation, administration and services, and purchasing operations. Special awards, ranging from RCA televisions to special parking permits, were presented to top individual achievers.

The effectiveness of RCA's efforts in the Zero Defects program to enhance the reliability and value of its products was evidenced by the recognition received by its customers. On November 22, 1966, the Communications Systems Division, Camden was presented with the first US Air Force Craftsmanship Award. By 1968, the three sister divisions at Moorestown, NJ; Princeton, NJ; and Burlington, MA also received this honor. These four awards were especially significant, since the Air Force had only presented a total of nine such awards nation-wide by that time.

The Zero Defects program proved to be a very effective means to enhance RCA's Defense Electronic Products group performance and earnings, while strengthening its reputation among its customers. This program provided the foundation for many successful follow-on campaigns conducted since.

- 1) RCA CSD, Camden was the first winner of the company-sponsored "Zero Defects Olympic Decathalon," receiving the Arthur L. Malcarney trophy in February 1965 for outperforming the other three RCA defense divisions in the competition for improved operating procedures across the total work force. The awards ceremony was held in Building #2-1, Camden, NJ.
- 2) Thousands of RCA Camden employees gathered at Johnson Park in early 1965 for a "Zero Defects" program rally. Under the slogan "Do It Right-The First Time, "RCA's four defense divisions, as well as several of its consumer businesses, instituted this program in 1964 to motivate employees at every level to reduce operating costs, improve efficiency and produce higher-quality products for its customers.
- 3) An RCA Camden employee proudly presents his special parking permit award for outstanding individual achievement in the RCA Zero Defects program, 1965.
- 4) On November 22, 1966, RCA Camden received the first US Air Force Craftsmanship Award in recognition of its superior efforts in enhancing the reliability and quality of its defense communications products.











1) In July 1964, RCA opened a new computerized facility for the design and manufacture of commercial electronic parts in Deptford, NJ. This facility, the largest of its kind in the world, became the new home for RCA Parts and Accessories. Formed in 1956 as the RCA Components Division, it was originally located in Building #60, 19th and Federal Streets, Camden, NJ.

RCA Components Division: Formation and Expansion to Deptford, NJ

To better serve its customers and its own manufacturing divisions in a growing market, RCA formed a new division in 1956: Components. Headquartered in Building #60, 19th and Federal Streets, Camden, NJ, the Components Division was a functional organization created to design, develop, manufacture and market a wide variety of products. Supported by additional facilities at Findlay, OH and Needham Heights, MA, the division was responsible for production of electromagnetic devices (deflection yokes, high-voltage transformers, memory storage devices), electromechanical devices (speakers, relays, sound-powered telephones), materials (ferrites, magnets, memory cores, chemical products, batteries), test equipment, renewal components (rectifiers, miniature lamps, hi-fi accessories) and over 40,000 service parts for other RCA divisions.

This activity continued to expand, until it became necessary to relocate to larger facilities. On February 28, 1964, ground was broken on a 132-acre tract of land in Deptford, NJ for a modern 200,000-square-foot building. It was completed by mid-summer, and operations were transferred here from Building #60 by July 31. This was the new home for RCA Parts and Accessories—the largest commercial electronics parts center in the world. Upon its opening, the center stocked 60,000 different line items-a total of six million parts. Operating 24 hours a day, seven days a week, Parts and Accessories was prepared to meet any emergency for needed spare parts. The facility had a totally computerized parts inventory and tracking system, as well as automated, high-speed packing equipment.

RCA Parts and Accessories operated under the RCA Consumer Products group in 1965, but its support activities grew to include replacement parts for the Broadcast Systems and the Semiconductor Divisions. In 1975, Parts and Accessories merged with RCA Distributor Products to form the Distributor and Special Products Division (DSPD). Distributor Products had previously been the supplier of picture and receiving tubes to the RCA Electronic Components and Devices group. DSPD was also responsible for the operation of the RCA Family Stores, which sold RCA products to employees on a non-profit basis. There were 29 Family Stores operating by the 1980's.

Other RCA Highlights: Consumer Products

The years 1956-1967 brought many new changes and developments in RCA Consumer Products. In 1957, Consumer Products consisted of the RCA Victor Television Division, RCA Victor Radio and Victrola Division and RCA Victor Record Division. The Television Division was headquartered at Cherry Hill, NJ, with its major manufacturing activities at Indianapolis, IN and Lancaster, PA. The Radio and Victrola Division, also headquartered at Cherry Hill, had its main production groups at Canonsburg, PA and Cambridge, OH.

In November 1958, RCA announced plans to expand and realign five of its midwestern manufacturing plants. The changes focused on the home instrument and electronic component product lines. The Cambridge, OH plant was expanded beyond the production of tape recorders and some hi-fi instruments to include radios and combination AM-FM hi-fi units. The Bloomington, IN plant was enlarged with a 120,000-square-foot addition to increase its production of monochrome and color television sets. The Indianapolis, IN plant, which added 208,000 square feet of floor space in 1957, began to manufacture television compo-



nents, ferrite cores and radios, in addition to its existing line of portable TV sets, records and electron tubes. The Findlay, OH plant ceased manufacturing of television components and began to produce transistors and other semiconductor devices as a new member of the RCA Semiconductor and Materials Division. Finally, the Canonsburg, PA plant ceased production of radios and records and was phased out in 1959.

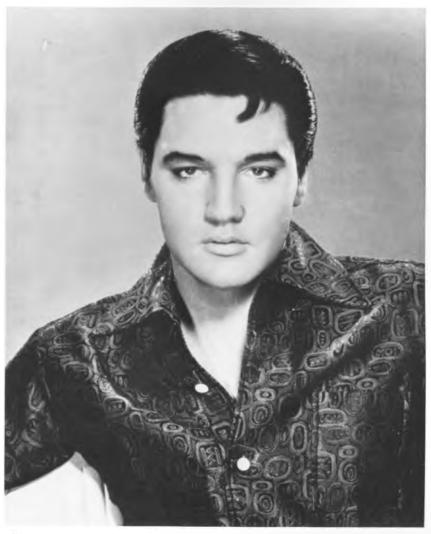
With the expansion of RCA's activities in the growing computer field, the Cherry Hill facility began to shift operations from home instruments to electronic data processing. In 1961, Home Instruments moved from Cherry Hill to a consolidated operation at Indianapolis.

During this period, consumer product developments focused on stereophonic highfidelity record and tape players, transistorized pocket radios and both monochrome and color television receivers. Three RCA milestones of this period were: the production of the 10 millionth black-and-white TV (1958); the first miniature transistor radio to be produced entirely in the United States (1959); and the "Wireless Wizard" - the first TV remote control unit. Throughout the mid-1960's, RCA sales of phonograph and tape recorders continued to increase. The Home Instruments Division introduced a full line of reel-to-reel tape recorders and, in 1965, introduced eight-track tape players for both automobiles and homes.

RCA color television receiver sales, initially slow due to overall reluctance by the rest of the industry to convert to color, began to increase steadily in the early 1960's. In 1960, RCA color television turned its first profit. By 1963, over a million color television sets were in use, many of which were produced by RCA. In 1966, RCA introduced the first televisions to employ integrated circuits, as well as industry's first remote control for both VHF and UHF stations. A year later, RCA's first portable color TV—a 14 inch diagonal—was put on the market. At a suggested retail price of \$329.95, it became the lowest priced color set in RCA's history.

The RCA Victor Record Division continued as an industry leader, offering the best in musical talent and sound reproduction techniques.

One of the most significant events in the history of RCA Victor Records occurred on November 15, 1955, when a young, 20-year old singer signed a three-year recording contract with the Company. His name was Elvis Presley. This controversial rock-and-roll star was discovered by Steve Sholes, manager of popular artists and



2

repertoire for RCA Victor Records, in the fall of 1954. Sholes was in Nashville, TN on a hunt for talent and stopped in to see the local acts at the Saturday night Grand Ole Oprey show. Elvis, touring as "The Hillbilly Cat," completely amazed Sholes with his radical style. The rest was history. The teenage idol went on to record more best-selling songs than any other artist in the history of popular music. Throughout his 22 years with RCA Records, Elvis produced 149 singles which reached Billboard's Hot 100 Singles Chart and 92 albums which reached Billboard's Hot 100 Album Chart. He had 114 singles make the Top 40, 40 of which made the Top 10 and 18 of which reached the number one spot. Even after his death on August 16, 1977 at age 42, "The King" continued to be one of RCA's biggest selling artists. Since his death, 48 of his re-releases have gone gold. In 1984, RCA Records reached a milestone when it pressed the 1 billionth Elvis record.

2) Elvis Presley, the best-selling artist in the history of popular music, signed his first contract with RCA Victor Records on November 15, 1955. Over the next 22 years, Elvis produced 149 singles which reached the Billboard Hot 100 Singles Chart. Even after his untimely death on August 16, 1977 at age 42, "The King" remained one of RCA's biggest selling artists. The one billionth Elvis record was pressed by RCA in 1984.

The RCA Victor Record Division made significant progress in sound reproduction techniques in the 1960's. In 1961, the division introduced a new electronic process for reproducing previously-released monaural recordings as stereo recordings. A year later, it opened the world's largest and most modern recording studio, in Rome, Italy. In 1963, RCA Victor Records announced *Dynagroove*, a new and improved process of sound reproduction.

Also during this period, RCA Records experienced tremendous sales growth—through expansion of its Record Clubs, domestic retail outlets and international markets. In 1965, the division released its first pre-recorded 8-track cartridge tapes, for both automobile and home use. The 8-track system was enthusiastically received: Americans now had the capability to play pre-recorded music in their cars. In 1966, the RCA Record Division reached its third consecutive year of all-time sales volume, bringing "His Master's Voice" to millions around the globe.

Other RCA Highlights: NBC

Throughout the late 1950's and early 1960's, the National Broadcasting Company continued to lead the television industry in the direction of full-color broadcasting. Total annual colorcasts of 486 hours in 1956 increased to 647 hours in 1957, 668 in 1958, 724 in 1959, and 1,034 in 1960. CBS and ABC had no colorcasts in 1960.



8 TO 9 PM LIVE IN COLOR III 4



By 1962, about 68 percent of NBC's total evening programming was in color and, in 1966, NBC became the first full-color network in the US.

A major achievement in television broadcasting occurred in 1963, when network color pictures were sent and received via the RCA-built Relay satellite and broadcast on NBC-TV's Walt Disney's Wonderful World of Color.

NBC television news coverage continued to grow, with special attention given to significant events. The team of Chet Huntley and David Brinkley established a new standard in news reporting, beginning with NBC's coverage of the 1956 Democratic National Convention in Chicago. Soon after, *The Huntley-Brinkley Report* became the most popular TV news program. Memorable events covered by NBC included the 1962 Cuban missile crisis (more than 100 special programs, reports and bulletins) and the assassination and funeral of President John F. Kennedy (71 hours of coverage).

By 1965, NBC distributed its programs to 80 countries and more than 300 TV stations throughout the world. The NBC TV Network consisted of 202 affiliates, including five owned stations. The NBC Radio Network also had 202 affiliates, including six owned stations.

Other RCA Highlights: RCA Communications, Inc.

The new technology of computers brought great improvements to operations and services of RCA Communications, Inc. in the 1960's. In 1964, and Electronic Telegraph System (ETS), consisting of custom-built RCA computers to electronically route, process and transmit international message traffic, was installed in its New

- 1) The Perry Como Show returned for the fall 1956 season in "living color" from the newly-completed NBC color studio in New York's Ziegfield Theatre. By 1966, the color boom hit America, and NBC became the first full-color network.
- 2) In 1959, the television western Bonanza was introduced by NBC. Lorne Greene (left) starred as patriarch Ben Cartwright, with his sons Hoss, Little Joe and Adam, played by (l-r): Dan Blocker, Michael Landon and Pernell Roberts. Combining action, soap opera and sociology, this popular show was the first hourlong western series aired in color. By 1970, Bonanza had become the world's most popular TV series, with an estimated weekly audience of more than 400 million people in 83 countries.

York City facilities. This new capability was added to accomodate the expanded channel capacity made possible by communications satellites.

Another highlight was the 1965 introduction of DATEL, a service for international data traffic from punched cards or tape, allowing transmission speeds of up to 1,200 words per minute between the US and the UK. In 1966, RCA Communications introduced an Automated Information and Reservations Computer Operated Network (Air Con), a computerized service for message processing and automated airline reservations.

Diversification Begins at RCA (1965-1966)

In 1965, RCA entered a new period of corporate change and diversification which would take it into entirely new fields beyond the traditional businesses of communications, electronics and entertainment.

Applying computer and electronic technology to processes used in the printing industry, RCA formed the Graphic Systems Division in March 1965. Stanley W. Cochran, formerly division vice-president and general manager of DEP's Communications Systems Division (CSD), Camden, took the same position in the new venture. A new 25,000-square-foot building in Dayton, NJ (near Princeton) became the new home for the 125 employees chosen to develop, manufacture and market these systems. J. M. Hertzberg succeeded Cochran as CSD's vice-president and general manager.

In 1966, two major advances were announced by the Graphic Systems Division. One was the Graphic 70 Videocomp, an electronic typesetter which had the capability to set the entire text for a newspaper page in two minutes through the use of television and computer techniques. The other was the Graphic 70 Color Scanner, which electronically produced the four basic color separations needed in full-color printing.

January 1, 1966 marked the passing of an era at RCA. David Sarnoff stepped down from his post as Chief Executive Officer, passing the title to RCA President Elmer W. Engstrom. Engstrom vacated the position of President, and Sarnoff's son, Robert, stepped up from the post of Chairman of the Board of Directors at NBC to become RCA President.

That same year, a corporate decision was made to spend \$198 million to build 11 new plants and expand 15 existing facilities. It was the largest domestic capital expenditure in RCA's history.

A series of new RCA business ventures commenced in 1966. The RCA Service Company was awarded multi-million dollar contracts to operate two Job Corps Training Centers for the





1

Office of Economic Opportunity. An Instructional Electronics Department was formed by RCA to capture new business in the educational market through sales of television systems, cameras, learning laboratories and related equipment. An agreement was reached with the pharmaceutical firm of Hoffman-LaRoche for joint development of new electronic equipment for the medical industry. RCA Magnetic Products Division was formed to develop new business in magnetic tape for industrial and home use.

It was also in 1966 that RCA began to expand beyond its core businesses in communications, electronics, broadcasting and entertainment. The first move was into the publishing field, when the corporation acquired Random House, Inc. Later that year it ventured into the car rental business, acquiring the Hertz Corporation. These transactions were the first of a series of major changes in the business activities at RCA which would take place over the next decade. RCA had entered a new period of modernization and diversification that would affect all aspects of its corporate life.

Financial Summary (1956-1967)

From 1956 to 1967, the Radio Corporation of America grew from a \$ 1 billion to a \$3 billion business, strengthening its position as one of the world's foremost communicationselectronics organizations. Its work force increased from 78,500 to 120,000, with activities spanning the globe. Pioneering activities in the fields of computers, sophisticated defense electronics, consumer electronics, television broadcasting and microelectronics research were all major factors in this tremendous growth. The corporation was, however, on the verge of the most challenging period in its history. Changing market conditions would cause RCA to embark upon a radical program which changed not only its business direction, but also its very identity.

3) Symbolizing the start of a new era of change and diversification at RCA, the corporate monogram was modified and introduced on October 1, 1965. The new monogram (right), with a trimmer look, replaced the previous version (left) which had been in use for the past 43 years.



Chapter 9

Diversification, Realignment and Return to Core Strengths (1968-1985)

"That's one small step for a man—one giant leap for mankind."

— Neil Armstrong

Apollo 11 Commander, July 20, 1969

he resignation of David Sarnoff as Chairman of the Board of RCA in 1966 marked the end of an era in the traditional businesses of communications, electronics, and entertainment. A new age of diversification and modernization had arrived at RCA. The next decade would bring sweeping changes throughout the corporation, affecting its management, organization, business direction and identity. Through a series of acquisitions, RCA was transformed from a high-technology electronics company in 1966 to an electronics company surrounded by a conglomerate of service businesses in 1974.

The New Identity Program (1968)

The changes at RCA began in 1966 with the rise of Sarnoff's son, Robert, to the position of President. Upon taking office, Robert Sarnoff initiated a new communications program designed to modernize the corporation's image. During that year, diversification in non-traditional businesses started with the acquisitions of Hertz Corporation and Random House, Inc. In January 1968, Robert Sarnoff became President and Chief Executive Officer and announced the new program "to convey the modern character of RCA as a diversified enterprise that has evolved over the past half century from a pioneering base in communications and electronics to leadership in total information technology." This program, designed to modernize every facet of RCA's appearance from trademark to office design, applied to all operations, products, services, and advertising worldwide. The most notable change was the trademark. Replacing the 46-year-old design formed by the letters "RCA" underlined by a symbolic lightning flash and enclosed in a circle, the new mark employed the three letters in a bold contemporary design to appear as a distinctive single unit.

Astronaut Edwin E. Aldrin Jr., lunar module pilot, poses for a photograph beside the deployed flag of the US during the Apollo 11 extravehicular activity on July 20, 1969. His backpack contained the RCA Extra Vehicular Communications System (EVCS), which allowed him to communicate to fellow moonwalker Neil A. Armstrong (who took this photo) and to the world. The EVCS was designed and built by RCA's Defense Communications Systems Division, Camden, NJ.

1) In January 1968, RCA President and Chief Executive Officer Robert Sarnoff instituted a new communications program designed to modernize the corporation's image. The most notable change was the trademark, which was changed from the 46year-old design (left) to a bold contemporary design.



1

In February 1969, the board of directors voted to change the company's name from "Radio Corporation of America" to "RCA Corporation." The new name, approved later that year, was recommended to reflect the company's multi-national character.

RCA Organizational Realignment (1968)

To provide a maximum degree of effective management control over the company's increasingly diverse operations, President Robert Sarnoff instituted a major realignment of executive management and four major operating areas on January 1, 1968. The move affected the businesses of Services, Defense and Commercial Systems, Consumer Products and Components and Information Systems.

Charles M. Odorizzi was promoted to Senior Executive Vice-President, Services. His responsibilities included the RCA Service Company, RCA Communications, Inc., RCA Parts and Accessories, and the Hertz Corporation.

W. Walter Watts became Senior Executive Vice-President, Defense and Commercial Systems. His responsibilities included the Camden-based businesses of Defense Electronic Products and the Broadcast and Communications Products Division.

The Consumer Products businesses were combined with the Electronic Components and Devices businesses to form Consumer Products and Components under Senior Executive Vice-President Delbert L. Mills. His responsibilities included the RCA Victor Home Instruments Division, RCA Victor Record Division, RCA Victor Distributing Corporation, RCA Sales Corporation, RCA Magnetic Products Division, Distributor and Commercial Relations, and Electronic Components and Devices.

James R. Bradburn became Executive Vice-President, Information Systems, responsible for Electronic Data Processing, EDP Service and the Graphic Systems Division.

One month later, a number of these activities were renamed to reflect more broadly the nature of particular product lines. Electronic Components and Devices became
Electronic Components. RCA Victor Home
Instruments Division was renamed Consumer
Electronics Division. RCA Victor Record
Division changed to simply Record Division.
RCA Victor Distributing Corporation became
RCA Distributing Corporation. The Camdenbased Broadcast and Communications Products
Division change to Commercial Electronics
System Division, and the Communications
Systems Division became the Defense Communications Systems Division. Electronic Data
Processing was renamed Information Systems
Division. RCA Parts and Accessories and RCA
Laboratories dropped the "RCA" from their titles.

A new RCA business group was created in 1968 under Vice-President Anthony Conrad. Titled Education Systems, it included Random House, Inc., RCA Institutes, Inc., and the new product lines of Instructional Systems and Educational Electronic Products. Instructional Systems, based in Palo Alto, CA, represented RCA's full-scale entry into the field of computer-based instruction for school systems.

"His Master's Voice" Silenced

As part of the new corporate-wide communications and modernization program, the famous trademark of "His Master's Voice" was discontinued in 1969. The familiar image of Nipper listening to the Gramophone, symbol of quality RCA products since 1933, was dropped.



2) The new RCA communications program was designed to convey the modern character of the corporation as a leader in total information technology. The traditional image of "His Master's Voice" symbolized the past, and was discontinued. The four stained-glass panels in the tower atop Building #17, Camden, NI were removed on April 15, 1969 and replaced by four wooden panels depicting the new RCA trademark.

3) Southwest view of the Esterbrook Pen Company (white brick buildings) on Cooper Street, Camden, NJ November 1970. For years, both the Victor Talking Machine Company and RCA tried to purchase this structure, which was strategically located between Building #15 (left) and #10/13 (right). RCA finally succeeded in 1968. calling it Building #16. It was used for systems engineering, timekeeping operations and as a warehouse, but for only a short time. As part of a plant-wide consolidation and modernization program, Building #16 was razed by RCA in 1971. One year later, Building #15 followed. The area was used for a new parking lot.

The famous "Nipper Tower" atop Building #17 in Camden, NJ received a facelift. On April 15, 1969, the four stained-glass panels depicting "His Master's Voice" were removed and replaced by four square wooden panels displaying the new block-style RCA trademark. Three of the four stained-glass panels, valued at \$25,000 each, were donated to the Smithsonian Institution, Widener College, PA, and Penn State University, PA. The last panel was put into storage.

Consolidation and Modernization of the RCA Camden Facilities

Beginning in the late 1960's, a major program involving consolidation and modernization of the aging facilities at RCA Camden, NJ began. The program was instituted to provide increased efficiency and greater cost effectiveness in the commercial and government communications operations. First to go were Buildings #5, 6, and 7 on Front and Linden Streets. All three were donated to neighboring Rutgers State University. In 1969, the main

administration office (Building #2) and the Building #3 production facility were extensively renovated.

A second phase of the modernization program began in 1971. This phase involved modernization of five buildings and demolition of five others. Interior upgrades were made in Buildings #4, 8, 10, 13, and 17, where engineering, production and various support operations were located. The remaining structures were demolished, beginning with Building #16 on Cooper Street and Delaware Avenue. Formerly the Esterbrook Pen Company, Building #16 was acquired in 1968 and used as a warehouse and for systems engineering and time-keeping operations. It was razed in 1971 to provide additional parking for employees and visitors. Building #15, adjacent to #16 on Front and Cooper Streets, was torn down in 1972. It, too, was replaced by a parking lot. Buildings #11 and 24, adjacent to #10/13, were partially razed in 1973. Eleven years later, they were completely torn down. Finally, Building #1, located on Front and Market Streets, was demolished in 1977.



RCA's Changing Business Activities (1968-1970)

Following the promotion of Robert Sarnoff to the position of Chief Executive Officer in 1968, RCA engaged in a series of activities involving the divestiture of certain traditional businesses and the acquisition of new businesses beyond its traditional fields of communications, electronics, and entertainment.

The Radiomarine product line, including navigation and communications equipment for ships, was sold to the Electronic Assistance Corporation of Red Bank, NJ on June 30, 1968. RCA, however, continued to provide service for marine equipment through the RCA Service Company and continued its ship-to-shore communications service. The collaborative venture with Hoffman-La Roche, Inc. for the development, production, and marketing of advanced medical devices, which started in May 1966, was terminated in October 1968. The electron microscope line, produced at the Camden plant since 1940, was sold on June 30, 1969.

On January 7, 1970, David Sarnoff's resignation from the position of Chairman of the Board signified the end of an era at RCA. Upon accepting Sarnoff's resignation, the Board of Directors elected him the first Honorary Chairman in RCA's history. David Sarnoff was succeeded by his son Robert Sarnoff as Chairman of the Board. General Sarnoff stepped down due to failing health. After a 15-month illness, he died in December 1971.

The year 1970 was highlighted by acquisitions of three new businesses which were beyond the traditional realm of communications and electronics. Banquet Foods, formerly the F. M. Stamper Company — a leader in the frozen food industry — became a subsidiary of RCA in March. This was followed by the acquisition of Cushman & Wakefield, a leading commercial real estate firm, in October. Finally, Coronet Industries, Inc. of Dalton, GA agreed to merge with RCA. Coronet's business ranged from the manufacture of floor and wall coverings to commercial, residential, and institutional furniture.

RCA also entered the glass manufacturing business in 1970 with the completion of a \$19 million plant in Circleville, OH. The new plant began producing glass funnels and faceplates for large-screen color television picture tubes.

To more closely align its activities in semiconductor activities, RCA established the Solid State Division in 1970. A new Solid State



1) General David Sarnoff, RCA's guiding leader for half a century, stepped down from the position of CEO in 1966 and retired in 1969. He became ill shortly after and died in December 1971.

Technology Center was also created at Somerville NJ, co-located with the new division's headquarters. A \$10.7 million semiconductor manufacturing plant was constructed in Liege, Belgium in 1970, marking RCA's first electronics manufacturing facility on the continent of Europe.

RCA's Withdrawal from the Computer Business (1971)

By the end of 1970, RCA had made a significant investment in its computer operations. A new \$22 million peripheral equipment manufacturing plant was opened in Marlboro, MA in 1969 and doubled in size in 1970.

Plans were announced that same year for a \$16 million office building, also in Marlboro, to serve as the new headquarters for the corporation's computer business. At a September 15, 1970, press conference held at the Marlboro manufacturing plant to introduce RCA's latest line of computers, Chairman of the Board and Chief Executive Officer Robert Sarnoff announced that "it is our intention to make RCA a major multi-national enterprise doing business principally in computer-based information systems." Sarnoff also stated that the corporation was prepared to commit the necessary resources to attain an industry rank second only to IBM in the US.

On January 13, 1971, RCA announced a major realignment of its Information Systems group involving consolidation of support functions of the operating divisions and the

. . .

formation of two new divisions. The newlystructured organization was called RCA Computer Systems and consisted of five operating divisions: Data Processing, Systems Development, Graphic Systems, Memory Products, and Magnetic Products. L. Edwin Donegan, Jr., a marketing executive with 18 years of IBM experience, was hired by RCA in 1969 and promoted to the position of Vice-President and General Manager for RCA's Computer Systems in January 1971. Donegan had brought in a number of former IBM colleagues to run the newly-reorganized operation. On February 15, 1971, RCA announced plans to relocate the group's headquarters from Cherry Hill, NJ to Marlboro, MA. Groundbreaking ceremonies for the new headquarters at Marlboro were held in June.

Meanwhile, RCA Computer Systems was in the midst of the 1970-71 recession and customers were tightening their belts. The industry was suffering. GE had sold its computer division to Honeywell. Computer Applications, a leading software house, had

gone out of business. Through the fall of 1970, numerous smaller firms were consolidating or going bankrupt. Even IBM, the industry pacesetter, saw a decline in domestic profits in 1970. It had, however, introduced four new models of its System 370 between the fall of 1970 and early 1971. RCA had already invested significantly to keep pace with IBM and needed a great deal more to survive the recession and successfully compete in the years ahead.

On September 1, 1971, RCA announced that operations would relocate from Marlboro back to Cherry Hill. About two weeks later, on September 17, 1971, Robert Sarnoff announced that RCA was withdrawing from the general-purpose computer business. This decision resulted in a phenomenal one-time after tax write-off of \$250 million, equal to about 25 percent of RCA's book value. According to Sarnoff, it would have cost the corporation over \$500 million between 1971 and 1976 to remain in the computer business. The RCA Board of Directors felt that they could not sustain this. The business was sold to Sperry Univac.



2) Robert W. Sarnoff became RCA's President in 1966, CEO in 1968, and, in 1970, succeeded his father as Chairman of the Board. During his five-year tenure as Chairman, the corporation was reorganized extensively, and new non-traditional businesses were acquired.

More Divestitures, Reorganization, and New Corporate Management (1971-1976)

Between 1971 and 1976, RCA discontinued or divested itself of several other businesses which had become obsolete, marginally profitable, or non-profitable. Divestitures included the 16-mm projector business; the Graphic Systems Division; the Palm Beach Gardens, FL computer operation; RCA Institutes, Inc; Coronet Industries; Cushman & Wakefield; Microwave Devices; and the receiving tube operation at Harrison, NJ.

The Harrison operation was phased down in 1975. At this time the corporation had formed a new unit called the Picture Tube Division (PTD). The headquarters were moved from Harrison to Lancaster, PA. The Harrison plant closed in April 1976. Manufacturing operations of the new PTD were located at Scranton, PA; Marion, IN; Circleville, OH; Midland, Canada; Mexico City, Mexico; Sao Paolo, Brazil; and Juncos and Barceloneta, Puerto Rico. The Picture Tube Division was formed from elements of the former Electronics Components Division. The decline of the receiving tube market, resulting from the growth of the solid-state market, influenced the corporation's decision to realign this organization.

RCA also closed its Memphis, TN manufacturing plant in 1971, consolidating its television production at the Bloomington and Indianapolis, IN facilities.

The audio products line, consisting of radios, phonographs, and tape players, had declined to a mere 5 percent of RCA's consumer electronics business by 1974. Increasing foreign competition had overtaken RCA, causing the closure of its audio products business in 1975.

RCA made one final acquisition during the Robert Sarnoff years. In 1974, the UK food companies of Oriel Foods Limited and Morris & David Jones Limited were purchased.

Robert Sarnoff submitted his resignation from the position of Chairman of the Board on November 5, 1975. Anthony L. Conrad, who became RCA President in June 1971 and Chief Executive Officer in November 1975, succeeded Sarnoff as Chairman of the Board on January 1, 1976. Conrad, however, lasted only nine months at the top. After telling the Board of Directors that he had failed to file personal income taxes for the years 1971-1975, he resigned in September 1976.

Edgar H. Griffiths, President of RCA Electronics and Diversified Businesses, was elected President and Chief Executive Officer of RCA Corporation on September 16, 1976. Griffiths joined RCA in 1948, starting at the Camden, NJ plant. He rose through a succession of positions in financial operations at the RCA Service Company beginning in 1949, acquiring a strong background in financial management. Upon assuming the position of CEO and President, Griffiths proceeded with a plan that would take the corporation through yet another major series of divestitures and realignments over the next five years.



- 1) Anthony L. Conrad became RCA's President and Chief Operating Officer in 1971, Chief Executive Officer in 1975, and Chairman of the Board in 1976.
- 2) Edgar H. Griffiths became RCA's fifth CEO in September 1976 and the fourth Chairman of the Board in January 1980.

Divestitures of Non-Traditional Businesses, New Corporate Leadership and the Return of "His Master's Voice" (1976-1980)

RCA Corporation's policy of growth through diversification, started in 1966 with the acquisition of Random House and continued through 1974 with the acquisition of Oriel Foods and Morris and David Jones food distribution businesses, was reversed in 1976. Under Edgar H. Griffiths, president and chief executive officer, RCA began streamlining operations and refocusing again on its core businesses.

Shortly after becoming president in 1976, Griffiths set in motion a program to re-evaluate the usage of the "Nipper" trademark. On October 31, 1978, RCA announced plans to restore the famous symbol in a major corporate marketing campaign. A modernized version of the fox terrier and Gramophone was gradually phased back into use, appearing on products; in newspaper, magazine and TV advertising; on company vehicles, shipping cartons and sales literature. The revised symbol was brought back as an adjunct to the bold-style RCA logotype. The first RCA product to include the new Nipper design was a 13-inch color television receiver. It was then used extensively on the entire line of color receivers, as well as broadcast color TV cameras and closed circuit TV cameras.

On April 10, 1979, 10 years to the day when the original Nipper windows were dismantled from the famous tower atop Building #17 of the Camden plant and replaced by the RCA logotype, a new set of four stained-glass panels returned. To mark the occasion honoring the return of the landmark, Governor Brenden T. Byrne declared April 9 "Nipper Day" in New Jersey.

- 1) A modernized Nipper returned as RCA's valued symbol of quality products in 1978. Under a major corporate marketing campaign, the world-famous fox terrier and Gramophone reappeared on color TV receivers, broadcast and closed circuit TV cameras, company vehicles and sales literature.
- 2) The rededication of the Nipper stained-glass windows on April 10, 1979, was commemorated by this special first-day-of-issue envelope from the Camden, NI post office.
- 3) Aerial view of the RCA Camden plant in 1979, following the return of the Nipper windows in the tower atop Building #17.







RCA Commercial and Industrial Electronic Products: Avionics Systems and Mobile Communications (1968-1981)

Prior to the major organizational realignment of 1968, RCA's Camden-based commercial and industrial business activities extended from broadcast equipment and electron microscopes to automated beverage inspection machines and theatre motion picture projectors. These activities were reorganized in 1968 as the Commercial Electronics Systems Division (CESD).

Avionics Systems was successful in the commercial weather radar market. In the late 1960's, most of the major airlines selected RCA weather radar for their new fleet of Boeing 747 jets and other aircraft. In 1968, the TWA order was the largest single purchase of weather radar in airline history. In 1975, the Van Nuys, CA-based Electromagnetic and Aviation Systems Division introduced a new line of weather radar and distance measuring equipment for both the commercial and military aircraft industries. Known as PRIMUS, these equipments incorporated digital displays and microprocessor technology.

RCA's Mobile Communications business, operating at both Camden, NJ and Meadow Lands, PA, expanded its two way radio line in 1970 with medium priced systems designed to serve the small business market. In 1973, in cooperation with the RCA Solid State Division and the defense group of RCA Government and Commercial Systems, Mobile Communications introduced the TACTEC line of portable two way radios. TACTEC employed integrated circuits and offered more functions, better performance and higher reliability than previous models.

Due to changing market conditions and a 1980 RCA corporate decision to divest certain peripheral operations, both Avionics Systems and Mobile Communications were sold in 1981.

RCA Photophone, which had become part of the Broadcast Systems group, was also sold around this time.

Other products lines which had long been part of the Camden-based Commercial and Industrial electronic business were also discontinued between the late 1960's and mid-1970's. These included automated beverage inspection machines, electron microscopes and 16-mm projectors.

RCA Broadcast Systems (1968-1985)

The third and most successful product line of RCA's Commercial Electronic Systems Division (CESD) was Broadcast Systems. Barton Kreuzer succeeded Charles Colledge as Vice-President and General Manager of the division in late 1967. From 1968 until 1985, this Camden-based operation achieved numerous milestones in the design, development and production of color TV cameras, video tape recorders, broadcast transmitters, antennas and other peripheral equipment.

Customers included all segments of the broadcasting and video production industry. Sales offices, headquartered in the US, Canada, Australia, and England, served commercial production companies, educational and religious institutions, government agencies, military bases, corporate communications studios, satellite transmission centers and movie studios. Manufacturing facilities of RCA Broadcast Systems were located in Camden, NJ; Meadow Lands, PA; Burbank, CA; and the Jersey Channel Islands, UK.

Broadcast Systems experienced significant business growth in the late 1960's, due to the expansion of color television and the opening of new UHF stations. In 1968, 55 UHF stations went on the air for the first time, and RCA Camden provided transmitting equipment for over half of them. That same year, this group strengthened its position as the industry leader with the debut of the TK-44A color camera. A superior technical design allowed this new studio camera to operate at low light levels. By 1970, the TK-44A was the best selling camera in the broadcast industry.

In 1969, Broadcast Systems introduced a 30-kilowatt UHF transmitter that provided a 2:1 improvement in the technical quality of TV transmission quality. Continuing its reputation as the leader in multiple antenna systems, the division installed two tower antennas on the 100-story John Hancock Center in Chicago in 1970. In 1973, Broadcast Systems solved the technical problems of providing eight TV and four FM radio stations in San Francisco with a common antenna site to overcome poor reception caused by mountainous terrain. A multiple antenna was erected atop a 977-foot tower on Mt Sutro.

In 1970, Andrew F. Inglis succeeded Kreuzer as Vice-President and General Manager of the newly-named Communications Systems Division (CSD), which encompassed Broadcast Systems, Cable Systems, Closed Circuit TV Systems, Industrial and Automation Systems and Commercial Communications Systems. Inglis was succeeded by Neil Vander Dussen in 1977, who managed the division until 1979. Vander Dussen was followed by J.E. (Ed) Hill (1979-1981), Joseph B. Howe (1981-1982) and Joseph Volpe (1982-1985).

- 1) The TCR-100, introduced to the broadcast industry in 1969 and television stations in 1971, was the first automatic videotape cartridge recorder in the industry. For the first time, stations could show commercials and other short segment tapes automatically. The TCR-100 was recognized with the 1974 Emmy Award for technical achievement by the National Academy of Arts and Sciences. Over 300 were in use by 1982.
- 2) Standing proudly with the Emmy just received for technical achievement on the TCR-100 automatic videotape cartridge recorder were (l-r): Andrew F. Inglis, vicepresident and general manager, RCA Commercial Communications Systems Division; Irving K. Kessler, executive vicepresident, RCA Government and Commercial Systems; and Neil Vander Dussen, vice-president and general manager, Broadcast Systems Department. This photo was taken on June 20, 1974 in the Building #2-7 conference room, Camden, NJ.





1

One of the most significant achievements by RCA Broadcast Systems during this period was the development of the TCR-100 Video Tape Cartridge Recorder/Player. Introduced to the industry in 1971, this system changed the very nature of TV broadcasting operations. For the first time, stations could automatically air pre-recorded commercials, program promotions, station identifications and other segments lasting only 20 seconds or as long as three minutes. So revolutionary was RCA's achievement, that it was recognized with an Emmy Award in 1974 for technical achievement.

Two other contributions by RCA in video tape recording were the TR-600, introduced in 1974, and the TR-800, introduced in 1980. The TR-600, a quadruplex-type recorder/reproducer, provided cost-effective, built-in features which previously were offered as accessories. Approximately 800 units were sold to customers world-wide. The TR-800, a helical scan-type system, was intricately designed and very difficult to manufacture. Consequently, it was not produced in large quantities. Broadcast Systems also produced a line of portable recorders, which included the lightweight, battery-operated TH-50 for field use.

In 1983, RCA developed a new recording technique using half-inch VHS videocassette tape which achieved quality close to that of more expensive one-inch systems. Known as the "Chroma Trak" technique, the format was the basis for the camcorder, which RCA also pioneered. RCA received an Emmy Award in 1983 for its technical achievement with Chroma Trak.



3) RCA's Commercial Communications
Systems Division,
Camden, NJ, was a major manufacturer of video tape recorder/reproducer and editing systems, including both the quadruplex and helical scan types. The TR-800, introduced in 1980, was a full-feature, one-inch helical scan SMPTE type "C" format

recorder.

3

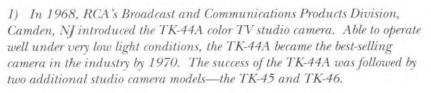
Broadcast Systems also continued as the leader and innovator in color TV cameras. In 1975, it unveiled the TK-76, the first self-contained, high-quality portable unit for electronic news gathering. Containing three imaging tubes and all necessary electronics, the TK-76 offered new flexibility in high-quality field operations. Within five years, over 3,000 units were sold and in use in over 50 countries.

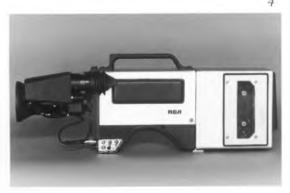




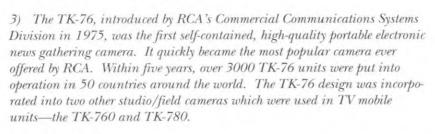








2) In 1978, the RCA TK-47 fully automatic color TV studio and field camera made its debut from Camden, NJ. It featured microprocessor control of both camera operation and the normally-complicated procedure of camera setup. RCA received an Emmy Award in 1981 for its development of digital techniques used in the TK-47.





- 4) In 1981, RCA Camden introduced Hawkeye, the first compact broadcast-quality color TV camera and video tape recorder in a single hand-held unit. This system provided new flexibility in electronic news gathering, making practical a single-person field video production unit.
- 5) The Charge-Coupled Device (CCD)-1 solid-state portable color TV camera, a joint development between RCA's Broadcast Systems Division and RCA Laboratories, was a significant technological breakthrough. It eliminated problems associated with conventional tube-type cameras, such as tube replacement, lag, comet tailing and image burn-in. First used by NBC in 1984, first deliveries began in 1985. The CCD-1 was the last TV camera produced by RCA.

In 1978, RCA Broadcast Systems developed the TK-47, fully automatic, microprocessor- based color camera. The TK-47's design permitted rapid, automated setup and operation at the touch of a button. It established new standards for performance, stability and reliability, earning RCA yet another Emmy Award in 1981.

The division introduced the first compact broadcast-quality color camera and video tape recorder in a single, hand-held unit in 1981. Titled the Hawkeye, this unit gave news gathering organizations the capability to perform practical field video productions by a single person. RCA earned an Emmy Award for this technical achievement.

Another technological achievement by RCA in color TV cameras was the development of the Charge-Coupled Device (CCD). A joint development between RCA Laboratories and Broadcast Systems, this solid-state model eliminated the problems of comet-tailing, image burn-in and tube replacement associated with conventional tube cameras. First used by NBC in 1984, the CCD-1 entered the market one year later. This technology has since become standard in the broadcast and consumer camera industries.

RCA, historically the leading supplier of broadcast transmitters and antennas, introduced a new line of advanced, solid-state VHF transmitters in 1979. Called the G-Line series, it consisted of 26 models in power levels ranging from 10 kilowatts to 100 kilowatts. Over 100 units were sold by 1981. Production was transferred from Meadow Lands, PA to Gibbsboro, NJ in 1983 and, the following year, a solid-state 100-kilowatt UHF model was added to the product line.





Another significant achievement in antenna systems was the design and construction of the world's largest multiple antenna atop the 110-story World Trade Center in New York City. Completed in 1979, the 351.5 foot RCA antenna tower handled 10 TV and 15 FM radio stations.

In October 1981, another RCA Broadcast Systems milestone was reached with the delivery of the 500th UHF TV antenna to station WTVS in Detroit.

Broadcast Systems also pioneered circular polarization of TV signals to reduce "ghosts" and improve reception. It developed the industry's first circularly polarized antenna for ABC's Chicago station WBKB-TV in 1975. In 1984, RCA received another Emmy Award for this innovative technique.

Although RCA was always a technical leader in the broadcast equipment industry, it gradually lost its leadership in market share. Increasing competition from Japan, several economic recessions and reduced research and development investments were all contributing factors. The Broadcast Systems Division suffered heavy operating losses between 1982 and 1984. The business, which had been headquartered at the Camden plant for 54 years, was relocated to a new facility in Gibbsboro, NJ in 1984. The division was closed by RCA in late 1985, ending a major chapter in the history of RCA.

6) For over half a century, RCA was the industry innovator and leader in broadcast microphones. Pictured here was the product line in 1974. which included the BK-11A generalpurpose velocity unit (far left), the BK-5A noise reducing uniaxial model (second from left) and the famous 77-DX polydirectional microphone (far right).

7) The 110-story World Trade Center in New York City, shown here in March 1974, became the home of the world's largest multiple TV antenna. The 351.5 foot antenna tower, designed and constructed by RCA Broadcast Systems, Gibbsboro, NJ, weighed 363 tons and, upon its completion in 1979, accomodated the antennas for 10 TV stations and 15 FM radio stations.







- 1) Overlooking San
 Francisco high atop a
 977-foot tower on Mt.
 Sutro is the custom
 antenna produced and
 installed by RCA
 Broadcast Systems in
 1973. The multiple
 antenna, which
 handles eight TV and
 four FM radio stations,
 solved the problem of
 poor reception previously
 caused by mountainous terrain.
- 2) In 1984, RCA Broadcast Systems designed and built new TV and FM radio broadcast antennas that were installed atop the Empire State Building in New York City.
- 3) In 1984, RCA Broadcast Systems moved its headquarters from Camden, NJ to a new building in Gibbsboro, NI, ending a 54-year tradition as the "landlord" of the Camden plant. The move to Gibbsboro followed the relocation of transmitter production from Meadow Lands, PA to Gibbsboro one year earlier. With the adjacent antenna assembly and test operation already in Gibbsboro, RCA now had consolidated all administration, engineering and production facilities of Broadcast Systems. Following RCA's decision to close the division in late 1985, the Gibbsboro facilities were utilized for defense electronics engineering and production.

RCA Government Communications Systems: Growth of a Systems Engineering Organization in Camden, NJ

By 1968, RCA's communications system business for the US Government had grown to occupy the major portion of the Camden plant. This business evolved from an engineering group in Building #10 in the early 1950's. Known then as Radiation Engineering, this section designed and produced airborne amplifiers, shipboard intercoms and portable combat radios. As the group grew, so did its status. It became Surface Communications Engineering in 1955, then Surface Communications Department in 1956. In 1957, the department initiated its first major system design and development effort: the North Atlantic Tropospheric Scatter System. By 1959, the group became the Surface Communications Division (SCD) of RCA Defense Electronic Products. With major programs like the AN/ GRC-50 tactical microwave radio relay, the "Micromodule" microelectronics program, AN/ PRC-25 combat radio, AN/WIC Polaris submarine intercom system, COMLOGNET data processing and message switching systems and the Dyna Soar program, the division was beginning to look less like a product supplier and more like a systems engineering organization.

In the early 1960's, RCA SCD participated in some formidable military communications systems projects. The division was prime contractor for the US Air Force 466-L World-Wide Electromagnetic Intelligence System, responsible for design studies, research and development, installation, training and field operations in secure communications, data collection, processing and dissemination. The division also played a major role, as an associate contractor, in the US Air Force 480-L (AIRCOM) Program. This work involved systems studies of all facets of a global communications system, including message handling, message and line switching techniques, digital coding, error detection and correction and various transmission media. A third major effort was the UNICOM program. As an associate contractor to Bell Telephone Laboratories, Inc., RCA SCD designed and built communications equipment for the US Army Signal Corps' Military Communications System for the continental US.

The Camden-based division firmly established itself as a major communications systems engineering organization upon winning and successfully completing the multi-million dollar Minuteman Sensitive Command Network/ Support Information Network program, as mentioned earlier.

By 1962, RCA SCD employed 5,000 people, including 800 engineers, in four states. The organization consisted of six major groups: Communications Systems, Advanced Techniques, Digital Communications, Electronic Warfare, Magnetic Recording and Ground Communications. The division merged with the RCA Aerospace Communications and Controls Division in 1963, becoming the RCA Communications Systems Division (CSD). Beginning that year, CSD became significantly involved in major design, development and production programs for NASA, as well as for the US Department of Defense.

In January 1968, the division was retitled the Defense Communications Systems Division (DCSD). By this time, over 7,700 of the 10,000 Camden plant employees belonged to DCSD, performing over 100 defense procurement contracts. These contracts were divided into the following major categories: Advanced Communications Technology, Communications Systems, Light Communications Equipment, Heavy Communications Equipment, Digital Communications Equipment, and Recording and Television Equipment. These groups were collectively responsible for the design and development of a wide range of communications systems for submarine, shipboard, manpack, vehicular, fixed site, aircraft, missile and space applications.

By the late 1960's, RCA DCSD had developed a solid experience base in numerous technical categories, including: system definition and integration; command and control; space communications; microwave communications; data processing and switching; HF, VHF and UHF radio; telemetry; interior communications systems (for aircraft and submarines); magnetic recording techniques; microelectronics; antennas; coding and modulation techniques; signal processing techniques; secure communications and anti-jamming techniques; and radio frequency interference.

From this foundation, five major business areas began evolving into what became the main product lines of RCA Camden (later renamed RCA Government Communications Systems) for the US Government for the next two decades: space communications, microwave communications, digital communications, recording systems and information processing systems. The highlights of these businesses are described in the following pages.

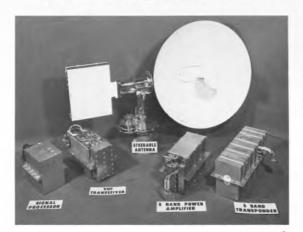
RCA Contributions to the Apollo Program (1963-1972)

In 1961, President John F. Kennedy pledged to place Americans on the moon within 10 years. By 1963, NASA was flight testing a new spacecraft under the Apollo program. This spacecraft consisted of three modules or sections. The Command Module (CM) was the section which would carry three astronauts into space and back to earth. The Service Module (SM) was connected to the CM, housing the rocket engines, fuel and electronic equipment. These two sections were collectively called the Command/Service Module (CSM). The third section was the Lunar Module (LM), which would transport two of the three astronauts to the surface of the moon, serve as a shelter for the astronauts while on the moon, and act as a launch pad to return the astronauts back to the orbiting CSM.

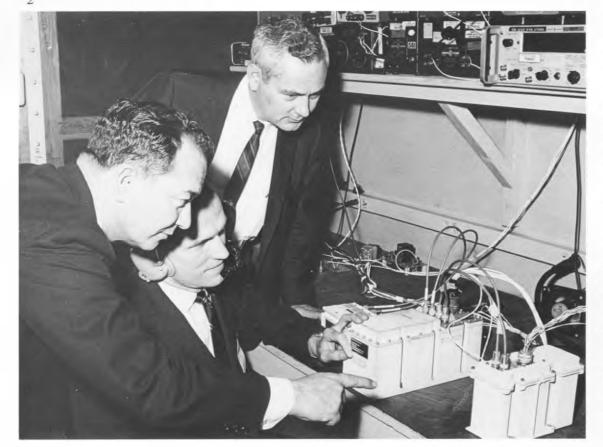
RCA Camden, as a subcontractor to Grumman Aircraft Engineering Corporation since 1963, was responsible for the entire LM communications subsystem effort on the Apollo program. This subsystem consisted of VHF transceivers; S-band amplifiers, transponders, transceivers, and steerable/erectable antennas; and signal processing equipment. The VHF transceivers were for voice communications between the LM and CM. The S-band system provided a two-way direct link between the LM and earth. The Camden team managed this project, providing technical direction of five major subcontractors and two RCA divisions. The VHF transceivers were built at the Camden plant. The antennas were produced by the RCA Missile and Surface Radar Division (M&SRD), Moorestown, NJ.

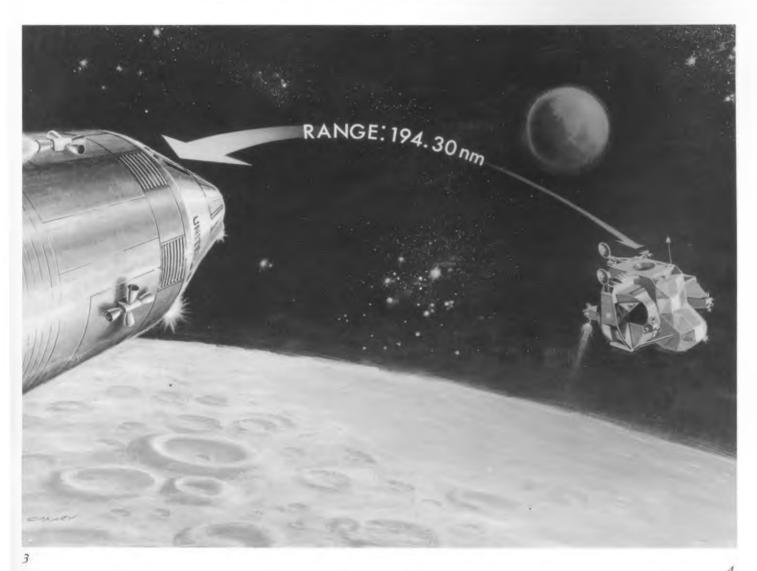
In 1965, RCA Camden's role was expanded to include the VHF voice communications for the CM as well. This work was performed under contract to Rockwell International.

The following year, a contract add-on was



- 1) RCA's Communications Systems
 Division, Camden, NJ
 was responsible for the
 entire Lunar Module
 communications
 subsystem for NASA's
 Apollo program,
 beginning in 1963.
- 2) Astronaut Frank Borman (seated, with headphones), flanked by RCA Camden Program Manager Jim Hamlin (left) and Apollo Communications Program Manager Sam Holt, checking out VHF ranging equipment developed for the Apollo missions in Building #1, October 1968. Two months later, Borman blasted off on the Apollo 8 mission.
- 3) RCA Camden designed and produced the VHF ranging system for the Apollo program, which allowed the Command Module (left) to determine the range of the separated Lunar Module up to nearly 200 nautical miles.
- 4) RCA President Robert Sarnoff (left), presenting the 1969 David Sarnoff Outstanding Achievement Award in Engineering to Ed Nossen, Systems Engineering Leader, DCSD, Camden, for his development of the Apollo VHF ranging system.





received to design and produce a VHF ranging system to provide the CM pilot with the range between his vehicle and the LM during separation, up to 200 nautical miles. The LM portion of this ranging system was delivered to Grumman. The CM portion was delivered to Rockwell.

Still another contract was awarded to RCA Camden in 1966, this one directly from NASA. This job was to provide backpack communications for the astronauts exploring the lunar surface. This system would link the astronauts to one another, with the LM, and (via the LM) with mission controllers on earth. In addition, this system would transmit biomedical data on the astronauts while they were engaged in Extra Vehicular Activity (EVA), as well as telemetry data on the status of their spacesuit systems. The backpack set, called the Extra Vehicular Communications System (EVCS), was designed and produced at RCA Camden and successfully used on all Apollo and subsequent manned NASA missions.



The first manned Apollo mission began on October 11, 1968 when Astronauts Schirra, Eisele and Cunningham blasted off atop a Saturn 1B rocket and flew a near-perfect 11-day mission. This was Apollo 7, which orbited the earth and provided the first live TV pictures from inside a manned US spacecraft. The pictures were taken by a camera built by RCA's Astro-Electronics Division (AED) and transmitted via communications equipment provided by RCA's Communications Systems Division (CSD) Camden, NJ.

Apollo 8, launched on December 21, 1968, carried Astronauts Borman, Lovell and Anders atop the most powerful rocket in history—the Saturn V—to a 103-mile high orbit to prepare for a flight toward the moon. The Saturn V checkout and launch countdown computers were supplied by RCA's Electromagnetic and Aviation Systems Division (EASD), Van Nuys, CA. This mission achieved a 60 to 70 mile orbit of the moon on December 24-25, 1968. A second RCA AED hand-held camera was aboard, which took pictures of the lunar surface. The pictures and the astronaut's comments were transmitted a quarter of a million miles back to earth via RCA CSD's on-board communications equipment. Apollo 8 proved that man could enter deep space, orbit the moon and safely return to earth.

The first test of the LM in earth orbit was performed by Astronauts McDivitt, Scott and Schweickart on Apollo 9, March 3-13, 1969. McDivitt and Schweikart entered the LM through a tunnel in the CM, separated from the CM, and practiced rendezvous and docking maneuvers in space. The first space walk since Gemini 12 in 1966 was part of the Apollo 9 mission.

Apollo 10, manned by Astronauts Stafford, Young and Cernan, lifted off May 18, 1969. After reaching lunar orbit, the LM separated from the CM, descended to 50,000 feet above the lunar surface, then powered its ascent engine and returned to dock with the CM.

The success of Apollo 9 and 10, as well as subsequent Apollo missions, was due partly to contributions by RCA's Aerospace Systems Division (ASD), Burlington, MA. RCA ASD provided the rendezvous radar/transponder, which determined the range, direction and velocity of the LM relative to the CM. The radar's antenna was built by RCA M&SRD.

RCA ASD also provided the control electronics for the LM. The Descent Engine Control Assembly (DECA) sent on-off and

throttling signals to the LM's descent engine and helped control gimbaling of the engine so its thrust was properly aligned through the spacecraft's center of gravity. RCA ASD also provided the Attitude Translation and Control Assembly (ATCA), which sent signals to the LM's 16 reaction control jets to automatically select the proper jets to control the spacecraft's attitude.

With the remarkable success achieved by Apollo 10, the stage was set for the ultimate achievement: the first manned landing on the moon.





1) This 4.5-pound RCA camera, developed by the Astro-Electronics Division, Princeton, NJ, took the first live TV pictures from inside a manned US spacecraft aboard Apollo 7 in October 1968 and the first close-up pictures of the lunar surface by an astronaut during Apollo 8 two months later. The pictures were transmitted live via RCA Camden's S-band communications equipment to millions of homes across America.

2) Astronaut Russell Schweikart, emerging from the hatch of the Apollo 9 Command Module (CM) for the first walk in space since Gemini 12 in 1966. Apollo 9 tested the first Lunar Module (LM) (in earth orbit). The first separation of the LM from the CM was successfully conducted. RCA electronics from five defense divisions all contributed to this and subsequent Apollo missions.

On July 16, 1969, civilian Commander Neil A. Armstrong, Air Force Colonel Edwin E. Aldrin, Jr. and Air Force Lt. Colonel Michael Collins blasted off from Launch Complex 39-A. Cape Kennedy, FL on a historic 225,000- mile journey to the moon. Four days later, Armstrong and Aldrin crawled from the Columbia Command Module (CM) into the Eagle Lunar Module (LM) while the Apollo 11 spacecraft was in orbit 50 miles above the moon. At 1:20 p.m. EDT, July 20, 1969, the Eagle separated from Columbia and began its descent to the lunar surface. Armstrong piloted the LM to a landing on the Sea of Tranquility at exactly 4:18 p.m., establishing "Tranquility Base." After dressing in their moon-walking spacesuits, overshoes, gloves and helmets and donning their life-supporting Extra Vehicular backpacks, the two astronauts were prepared to begin their exploration of the moon. At 10:56 p.m. EDT, July 20, 1969, Neil Armstrong stepped from the LM to become the first man to ever set foot on the moon. His movements were seen all over the world through the eyes of a TV camera mounted on the LM. When he proclaimed "That's one small step for a man, one giant leap for mankind," his historic words were transmitted to earth via backpack and LM-mounted communications equipment supplied by RCA Camden.

During the next two hours and 31 minutes, Armstrong walked the lunar surface, joined by Aldrin for one hour and 50 minutes. They spoke to President Nixon and planted an American Flag in the lunar soil. Aldrin then set up experiments to detect solar winds and moon quakes and placed a laser reflector on the lunar surface that would enable scientists to accurately determine the distance of the solar body from earth. The astronauts collected over 50 pounds of lunar rocks and soil, moved about the terrain in a demonstration of free movement (their weight was one-sixth that on earth), left a ceremonial plaque and a small disk containing messages from world leaders and finally returned to the LM.



3) RCA Camden supplied the vital communications which linked astronauts to each other, to the orbiting Command Module and to earth during all Apollo moon-landing missions, 1969-1972.



4) For their contributions to the Apollo communications program, 39 RCA DCSD, Camden engineers were presented "Snoopy" awards (named after the Apollo 10 Lunar Module) and received letters of congratulations from Astronauts Neil Armstrong and Frank Borman in January 1970. M.L. Long, DCSD vicepresident and general manager (far right) made the presentations. At 1:54 p.m. EDT, July 21, 1969, Armstrong fired the *Eagle's* ascent engine and the two blasted from the moon's surface to link up with Collins, who was orbiting the moon in the CM.

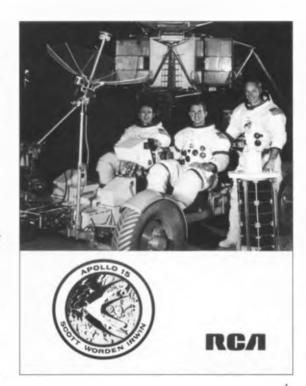
With the aid of yet another RCA system, the rendezvous radar/transponder, the *Eagle* redocked with *Columbia* at 5:35 p.m. EDT. The rendezvous radar, as well as the LM landing radar, were supplied by RCA ASD, Burlington, MA.

With the splashdown of the CM on July 24, 1969, the historic mission was completed. This amazing accomplishment was the result of several years of intense planning, design, development, production and testing of sophisticated systems and electronic subsystems by numerous government and industry participants.

RCA was justifiably proud of its achievements. Its five defense divisions collectively supplied TV cameras, the LM communications system, the LM-CM VHF communications system, the EVCS backpack system, the moonmounted erectable communications antenna, the LM landing radar, the LM-CM rendezvous radar and VHF ranging system, the LM control electronics (ATCA and DECA), and the Saturn V rocket countdown computers. Additionally, RCA M&SRD land and ship-based radars around the globe tracked Apollo/Saturn during the flight and RCA AED-supplied TV scan converters in California, Spain and Australia transformed Apollo's slow-scan black-andwhite TV to commercial standards for world-wide live broadcasting. Still another RCA contribution was the solid-state transmitter that was used in the rendezvous and LM landing radars. It was designed and built by the Solid State Division, Somerville, NJ.

But, even after all these contributions, RCA was not done with the Apollo program. Several new developments were destined to play major roles in subsequent Apollo missions.

The last three Apollo missions employed the Lunar Roving Vehicle, a wheeled vehicle used by the astronauts during their surface explorations. RCA Camden, under a 1968 NASA contract, developed the Lunar Communications Relay Unit (LCRU) for use on Apollo 15-17. This portable, self-contained system transmitted voice, telemetry and color television from the lunar-based astronauts and received voice and data directly from earth, without the LM as a relay. The LCRU was



mounted on the front bumper of the Lunar Roving Vehicle, allowing the world to witness the moon-walking adventures of Astronauts Scott and Irwin (Apollo 15, August 1971), Young and Duke (Apollo 16, April 1972) and Cernan and Schmitt (Apollo 17, December 1972).

The first laser altimeter to fly in lunar orbit was supplied by RCA's Burlington, MA division for Apollo 15. Used in the CM in conjunction with a metric camera, it permitted, for the first time, accurate mapping of the geographical and topographical characteristics of the lunar surface. As a result, scientists were able to learn the depths of craters and the height of mountains. This laser system was also used on Apollo 16 and 17.

Another RCA contribution to the Apollo 15-17 missions was the Ground-Commanded Color Television Assembly (GCTA), consisting of a color TV camera and an earth-controlled unit. This system, built by RCA AED, Princeton, NJ, permitted complete earth-based command and control of a color TV camera on the moon. By means of radio remote control, NASA's Manned Spacecraft Center in Houston, TX was able to turn the camera on and off, raise, lower and turn the camera, adjust the zoom lens and operate the automatic light control. The camera was mounted on the Lunar Roving Vehicle during the astronauts' stay on the moon. It was then

1) Astronauts (l-r) Irwin, Scott and Worden pose with the Lunar Roving Vehicle, which was first deployed during their Apollo 15 lunar explorations in August 1971. Mounted on the vehicle's bumper were two advanced RCA-supplied systems: the Lunar Communications Relay Unit (LCRU) and the Ground-Commanded Color Television Assembly (GCTA) camera. The LCRU permitted the first direct two-way link between the earth and moon without a relay. The GCTA allowed the first automatic earthcontrolled color TV coverage on the moon. RCA Government Communications Systems, Camden, NI supplied the LCRU and RCA Astro-Electronics, Princeton, NJ provided the GCTA. Both systems were also used on Apollo 16 (April 1972) and Apollo 17 (December 1972).

2) RCA's Camden-Princeton team, responsible for the Lunar Communications Relay Unit (LCRU) and Ground-Commanded TV Assembly (GCTA), were recognized with NASA's Group Achievement Award in October 1971 for providing "flawless television, voice and data coverage" from the moon during the Apollo 15 mission.



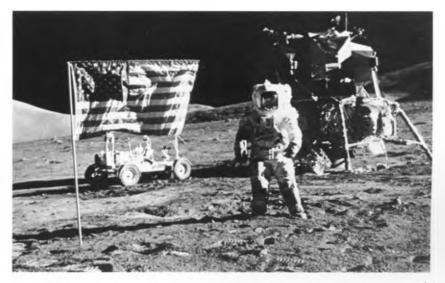


3

left behind, allowing the world to watch for the first time, the actual LM liftoff from the moon on Apollo 15. It was again used on Apollo 16 and 17.

A final noteworthy contribution by RCA to the Apollo program was the Coherent Synthetic Aperture Radar (CSAR), supplied by RCA Camden for NASA's Lunar Sounder Experiment. Deployed on Apollo 17, CSAR transmitted pulses at three different frequencies from the CM to the moon's surface to detect subsurface structure. The reflected signals were received, processed and optically recorded on film. Upon the return of Apollo 17 to earth, the film was processed and fed into an optical correlator, producing maps which showed characteristics of the lunar surface and subsurface to a depth of 1000 meters.

The Apollo moon-landing missions ended in December 1972, after a decade of historic achievements, including six successful moon landings. RCA's numerous contributions were recognized by NASA, the electronics industry, the US Government and the world. The corporation had further solidified its position as a world-wide leader in aerospace communications-electronics through the Apollo program and would continue this trend in future space programs.



- 3) Another pioneering achievement by RCA Government Communications Systems group of Camden, NJ for NASA was the Coherent Synthetic Aperture Radar (CSAR), deployed on the Apollo 17 Command Module in December 1972. A critical piece of the Lunar Sounder experiment, CSAR provided detailed maps of the lunar surface and subsurface to a depth of 1,000 meters, allowing scientists to study the origins of lunar craters.
- 4) Scientist-Astronaut Harrison H. "Jack" Schmitt, lunar module pilot for the Apollo 17 mission, photographed by fellow moon-walker Eugene A. Cernan at the Taurus-Littrow landing site beside the deployed US Flag, December 1972. In the background were the Lunar Roving Vehicle and the Challenger Lunar Module. This was the last manned landing on the moon. Photo courtesy: NASA.

1) View of Skylab 1, America's first space station, taken from the Skylab 2 Command/Service Module, June 1973. RCA Camden supplied the VHF ranging system, VHF telemetry transmitter, video tape recorders and Airlock Module (ALM) data recorders for the Skylab program, which conducted numerous significant scientific experiments through February 1974. (Photo courtesy: NASA.)

2) The Apollo-Soyuz Test Project, the result of agreements reached between the Academy of Sciences of the USSR and NASA in April 1972, was the first international manned space mission. Conducted July 15-24, 1975, this historic docking was accomplished with the assistance of the RCA Camden-built VHF ranging system. This was the only US-made electronic system aboard the Soviet spacecraft. RCA Camden also provided the video tape recorders, same as those used on Skylab, which were the world's first space qualified and proven. (Photo courtesy: NASA.)

RCA Camden's Contributions to Skylab and the Apollo-Soyuz Test Project (1973-1975)

The pioneering achievements by RCA's Government Communications Systems group, Camden, NJ for the Gemini and Apollo programs were applied to the next two major NASA manned space programs: Skylab and the Apollo-Soyuz Test Project.

The Skylab space station project was conducted in four phases from 1973 to 1974. Skylab 1-2 and Skylab 3, launched May 25 and July 28, 1973 respectively, carried the necessary subsystems into space for America's first space station cluster. Skylab 4, launched November 16, 1973, was the final and lengthiest mission, lasting until February 8, 1974.



RCA Camden's contributions to Skylab included the VHF ranging system and VHF telemetry transmitter. The ranging system, same as the one which performed flawlessly on the Apollo program, included the Ranging Tone Transfer Assembly (RTTA), Digital Ranging Generator (DRG), and two VHF transceivers. The telemetry transmitter was the same solid-state FM-FM/PCM-FM transmitter which logged over 600 hours of reliable communications on the Gemini program without a single failure.

RCA Camden also supplied video tape recorders (VTR's) and Airlock Module (ALM) data recorders for Skylab. The VTR's provided a color TV record of the experiments conducted by the astronauts. These were the first VTR's to be space qualified and space proven. The ALM recorders were refurbished and slightly modified Gemini recorders, some of which were actually recovered from previous missions. They were used on Skylab to record narrow-band digital and analog instrumentation data from various sensors.

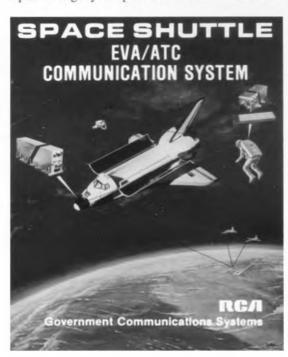
The VHF ranging system and VTR's used on Skylab were also used on the historic Apollo-Soyuz Test Project, the in-flight linkup of US and USSR manned spacecraft. The RCA Camden-built VHF ranging system was the only US-made electronic system aboard the Soviet Soyuz spacecraft.



1) Continuing its legacy in space communications, RCA Camden began producing the Extra Vehicular Activity/Air Traffic Control (EVA/ ATC) communication system for NASA's Space Shuttle program in 1978. The EVA/ ATC system has been successfully deployed on all Shuttle missions through the present day.

RCA Camden's Contributions to the US Space Shuttle Program

RCA's Government Communications Systems of Camden, NJ continued to build upon its legacy of space communications when



it was awarded an \$8.6 million contract from NASA's Johnson Space Center, Houston, TX in June 1978 to produce two types of systems for America's Space Shuttle. Collectively called the Extra-Vehicular Activity/Air Traffic Control, or EVA/ATC, the system included an 8.7-pound 180-cubic-inch backpack unit for communications between space-walking astronauts and the orbiting Shuttle, and an 18pound, 530-cubic-inch VHF transceiver mounted in the Shuttle. The latter unit served two puposes: to communicate to the spacewalking astronauts and, upon the Shuttle's reentry of the earth's atmosphere, to communicate with "chase" aircraft and air traffic control stations.

The initial contract called for production of 14 backpack units, five Shuttle-mounted units, and options for additional spares. Beginning with Space Transportation System (STS)-1 Columbia in April 1981, the EVA/ATC system has performed successfully on all Space Shuttle missions since, and will continue to be deployed on future missions.

1

2) John Sheldahl (left), project leader and Samuel B. Holt, aerospace programs manager, RCA Government Communications Systems, Camden, NJ, in 1979 with the two units of the EVA/ATC system for the Space Shuttle. The unit on the left is the 8.7-pound backpack EVA radio, the other is the 18pound, Shuttlemounted ATC receiver. Chuck Shelton was the design manager for the project.



RCA Camden's Tactical Microwave Communications Programs: From AN/GRC-50 to AN/TSC-100

From its pioneering beginnings with the nation's first UHF microwave relay circuit between New York and Philadelphia in 1936, RCA Camden grew to become one of the leading suppliers of microwave communications systems in the US. This leadership was evidenced by the numerous contributions to the commercial radio and television broadcasting industry for over 50 years.

With the growing emphasis on defense programs in the 1950's, the Camden-based Surface Communications Division (SCD) of RCA Defense Electronic Products began to apply this experience to the design, development and production of tactical, shelterized systems for the US military services. The first major program was the AN/GRC-50 VHF radio relay, designed and produced for the US Army Signal Corps through the 1960's. Nearly 2,000 of these voice transmission units were delivered by the end of the decade.

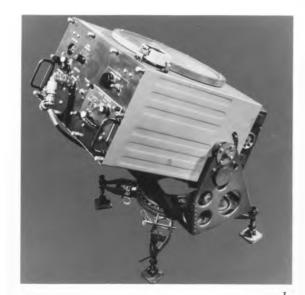
The success of the AN/GRC-50 was followed by the AN/TRC-97 and 97A Tropospheric Scatter Radio Relay Equipment. A complete tactical communications facility capable of relaying multichannel voice, teletype or data in a single 6'x 6'x 6' shelter, the AN/TRC-97 was a vital system for the US Marine Corps in Vietnam. The AN/TRC-97A was used by the US Air Force. Ruggedly built, these shelters were dropped by helicopter into remote areas to support operations requiring quick reaction and a high degree of mobility. Design and initial production of 18 sets occurred at the Camden, NJ plant. Subsequent production was transferred to the division's Cambridge, OH facility. By 1969, over 100 units had been delivered and deployed to the jungles of Vietnam.

The AN/GRC-50 and AN/TRC-97 were both designed by the Heavy Communications Equipment section of RCA SCD, Camden. Production was handled by both the Camden and Cambridge, OH plants.

Recognized for its accomplishments on these programs, RCA Camden was awarded a contract in 1967 to produce advanced development models (ADM) of a variety of Super High Frequency (SHF) microwave terminals for the US tri-service Tactical Satellite Communications (TACSATCOM) system. The contract called for production of 20-each of five terminal types: The AN/TRR-30 Manpack receiver; the AN/TSC-79 Teampack, a 10-watt transceiver; the AN/MSC-57, a 200-watt transceiver for quarter-ton wheeled vehicles; the AN/TSC-80, a 500-watt transceiver for one-and-one-quarter-ton vehicles; and the AN/ASC-14, a 1000-watt

 The AN/TRC-97 Troposcatter Radio Relay, designed at RCA Camden, NJ and produced by both the Camden and Cambridge, OH plants, provided reliable quick-reaction, mobile communications for the US Marine Corps in Vietnam throughout the 1960's and early 1970's. The AN/ TRC-97A provided this same capability for the US Air Force.















In 1967, RCA's Communications Systems Division, Camden, NJ was awarded a contract to develop a family of transportable, SHF Tactical Satellite Communications (TACSATCOM) terminals for the US triservice program. Over the next four years, advanced development models produced were: 1) the AN/TRR-30 Manpack; 2) the AN/ TSC-79 Teampack; 3) the AN/MSC-57; 4) the AN/TSC-80, shown here undergoing tests by Nick Gambino (right) at RCA's manufacturing facility (Building #82) in Pennsauken, NJ; and 5) the AN/ASC-14 aircraft-mounted unit.



transceiver for aircraft. The AN/ASC-14 was built for the US Air Force, while the other four models were for the US Army.

Camden's manufacturing areas in Buildings #1 and #18 were insufficient to handle this large program. In 1968, production was moved to a leased facility (Building #82) at Route 130 and Bethel Avenue, Pennsauken, NJ. Here, manufacturing and test were carried out through 1971, when all units were delivered.

In December 1972, RCA Camden received a follow-on, sole-source award to produce two types of engineering development models (EDM). One was the AN/MSC-59, a 12-channel analog voice, trailer-mounted unit, which replaced the AN/MSC-57. Four were produced. The other was the AN/TSC-85, a 96-channel analog voice, shelterized system. Twelve were manufactured. Production for this phase and subsequent phases was carried out in Building #3 of the Camden plant. All EDM's were delivered to the US Army. By this time, this tri-service program, managed by the US Satellite Communications Agency (SATCOMA), Fort Monmouth, NJ, became known as the "Small Terminal" program.

In 1976, RCA Camden's Government Communications Systems group was awarded the third phase of this growing tri-service TACSATCOM program. Over the next two years, three models were produced for this Limited-Rate Initial Production (LRIP) phase. The models were the AN/TSC-85, a 90-channel analog voice unit; the AN/TSC-93, a 24-channel analog voice unit; and the AN/TSC-94, a 12-channel analog voice unit. The AN/TSC-85, which replaced the AN/MSC-59, and the AN/TSC-93 were produced for the US Army. The AN/TSC-94 was produced for the US Air Force.

Still another contract was received in 1978 to produce two new units for the US Defense Communications Agency (DCA). These were the AN/TSC-86, a 24-channel analog voice unit; and the AN/MSQ-114, a satellite control system.

A 1979 contract from the Air Force resulted in a limited production of the AN/TSC-100, a 96-channel analog voice/data unit.

Finally, in 1982, RCA Camden was awarded a \$107 million full-scale production (FSP) contract from the Air Force for (68) AN/TSC-94A, 24-channel analog voice/data units and (43) AN/TSC-100A, 72-channel analog voice/data units. This major award was the result of the fine efforts by the Camden team conducted for well over a decade, solidifying RCA Government Communications Systems' position as a recognized leader in tactical SHF transportable satellite terminals.







- 1) SFC Thomas Tarlton, US Army (left), who was attending a TACSATCOM terminal training program at the RCA Service Company in Cherry Hill, NJ, took advantage of RCA's AN/MSC-59 terminal to re-enlist live via satellite with his commander at Ft. Monmouth, NJ on December 18, 1974.
- 2) The AN/TSC-85(V)2 SHF TACSATCOM terminal, shown here both hanging from a rotary-wing aircraft and mounted on a 1 1/4-ton truck, was one of three Limited Rate Initial Production (LRIP) models built by RCA Camden for the US Satellite Communications Agency from 1976 to 1978.
- 3) The first deployment of RCA Camdenproduced AN/TSC-85 and 93 TACSATCOM terminals, rolling off a C-5A transport aircraft at Ramstein Air Base, West Germany enroute to the US Army VII Corps, November 1979.
- 4) The AN/TSC-100, a 96-channel analog voice/data transportable TACSATCOM terminal, was first produced for the US Air Force by RCA Camden beginning in 1979. Full-scale production of 43 systems, modified as the AN/TSC-100A, began in 1982.
- 5) The RCA GCS management team for the AN/TSC-100 TACSATCOM terminal, with a completed system about to be handed off to their US Air Force customer, December 1981, included (l-r): Roy Johnson, test superintendent; Clair Phillips, production manager; Marty Watson, program manager; Steve Piro, production control supervisor; John Watson, superintendent for assembly. The systems were manufactured in Building #3-1.
- 6) Acceptance testing of the RCA Camden-built AN/TSC-94A SHF TACSATCOM terminal in Building #3-1, 1984. Sixty-eight production units were subsequently delivered to the US Air Force.







RCA Camden's Shipboard Integrated Communications Programs: AICS and IVCS

RCA's heritage in communications systems and services for the US Navy dated back to 1919, the year the corporation was formed. Upon acquiring the Camden plant in 1929, RCA began manufacturing its own products and, with the formation of its first Government Department in 1931, began producing communications equipment for the Navy. Throughout the next three decades, RCA Camden supported its oldest Government customer by supplying sound-powered telephones, intercoms, public address systems, theatre projection and sound gear, transmitters, radio and TV broadcasting equipment, test equipment and various other communications-electronics devices.

This solid, long-term relationship was further extended in late 1963, when the Navy initiated a feasibility study with RCA to determine the overall communications requirements for its ships. The goal was to develop a single integrated shipboard communications system. The study led to a June 1964 award for RCA Camden to design and construct a feasibility model of a centralized automatic switching system. The resulting implementation of a l0-line, solid-state model demonstrated the soundness of RCA's recommended approach.

In 1967, RCA Camden, competing against several companies, was awarded a contract to build an advanced development model which could serve the needs of from 100 to 5000 users. Titled the Advanced Interior Communications System (AICS), it was delivered in early 1969 and was installed and underwent a technical and operational evaluation aboard the *USS Bunker Hill* in San Diego.

In November 1969, RCA Camden was awarded a production contract for five ship systems. Designated the Integrated Voice Communications System (IVCS) and nomenclatured AN/STC-1, it was produced for installation on LHA *Tarawa* class amphibious warfare ships.

At that time, IVCS was considered the most advanced shipboard telephone system in the world. The system combined the functions of conventional intercom, sound-powered nets and dial telephone systems. It consisted of two computer-assisted switching centers and two types of user terminals for automatic routing of communications. One terminal type provided access only to pre-assigned net circuits. The other was a push-button dial terminal, enabling access to all other authorized terminals, net



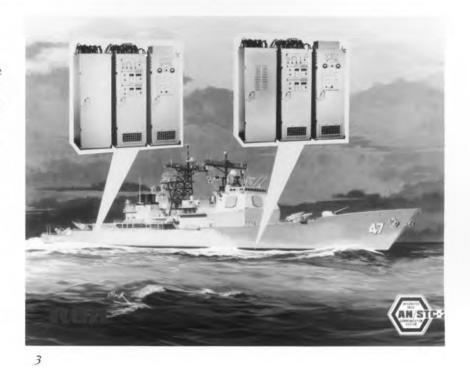


circuits and other general user nets. A single operator position controlled ship-to-shore interface when the ship was in port and communications with deployed forces on shore during amphibious assault operations.

In 1979, RCA Camden received a contract to build a newer, advanced version for the Navy's new AEGIS guided missile ships: the *Ticonderoga* (CG-47) cruiser class and the *Arleigh Burke* (DDG-51) destroyer class. Designated the AN/STC-2(V), it allowed commanders to communicate with users throughout their ships using a single headset, instead of a battery of telephones.

To date, the AN/STC-2(V) has been deployed on 20 cruiser class ships and the recently-commissioned first destroyer class ship, the *Arleigh Burke*. Additional systems are still being produced today by GE Camden for future CG-47 cruiser class and DDG-51 destroyer class ships.

- 1) The US Navy LHA Tarawa class amphibious assault ships were the first to receive the Integrated Voice Communications System (IVCS), the first centralized automated shipboard voice distribution system. Designed and produced by RCA Camden, this computer-controlled system was considered the most advanced shipboard telephone system in the world when it was deployed in the early 1970's.
- 2) Crew members of the LHA-1 Tarawa amphibious assault ship using the net terminal sets supplied by RCA Camden as part of the IVCS, or AN/STC-1, March 1977.
- 3) The AN/STC-2(V) Integrated Voice Communications System, an advanced version of the predecessor AN/STC-1, was deployed on the Ticonderoga (CG 47) cruiser in 1983. Like its predecessor, the AN/STC-2(V) employed both a fore and aft switching center. Each is capable of operating independently, but they are interconnected so that, in an emergency, either can take control of the entire system.
- 4) The automatic dial terminal of the RCA Camden-built AN/STC-2(V) IVCS, mounted in the bridge of the CG-47 Ticonderoga, allowed the commanding officer to communicate with all points of his ship from a single telephone. The AN/STC-2(V) IVCS is still produced today by GE's Government Communications Systems Department, Camden, NJ.







- 1) Beginning in 1972, RCA GCS, Camden designed, developed and built an advanced communications system for the Navy's Trident Ohio class ballistic missile submarine. The USS Ohio SSBN 726, commissioned November 11, 1981, was the first to carry the AN/BSC-1 system.
- 2) The RCA Camdenproduced Integrated Radio Room (IRR), or AN/BSC-1, permitted operation of the entire communications system on the Trident submarine from a single operator console. Two consoles were provided, offering the option of either single or dual control. As of 1991, a total of 19 AN/BSC-1 systems have been delivered to the US Navy.

RCA Camden's Submarine Integrated Communications Program: AN/BSC-1 IRR

Another major integrated communications system designed, developed and produced by RCA's Government Communications Systems group of Camden, NJ, was the Integrated Radio Room (IRR) for the US Navy Trident ballistic missile submarine. Developed under a series of contracts beginning in 1972, the computerassisted system, designated the AN/BSC-1, provides control of all submarine communications from a single operator console. RCA supplied all control subsystems, which included data switching, antenna interface and control monitor and test. Additionally, it supplied the VLF/LF and HF/UHF subsystems, as well as all support subsystems. This highly-successful program has been in production for nearly 20 years, continuing today under GE's Government Communications Systems Department at the same facilities in Camden, NJ.



Other Major Systems Integration Programs at RCA Camden: E-COM and GWEN

Two other major communications systems integration programs by RCA's Government Communications Systems group highlight the growth of the Camden-based government and defense business in program management and systems engineering.

In 1981, RCA's expertise in electronic message processing brought a multi-million dollar contract for design, integration and installation of an experimental system for the US Postal Service. Designated the Electronic Computer-Originated Mail (E-COM) system, it was designed to offer high-volume mailers high-speed delivery of notices, statements, bills and other computer-originated mail. The system was installed and began operating in January 1982, serving 25 cities. The Camden group also provided maintenance and training support following installation.

Another major program that demonstrated the systems engineering expertise of RCA GCS was the Ground Wave Emergency Network (GWEN). Awarded a \$97 million contract in 1984, GCS designed, built and installed a nation-wide emergency communications network for the US Air Force to be used for command and control of strategic forces. The network provides connectivity via low frequency broadcast-type relay stations throughout the continental US. If a portion of the network is inoperable or destroyed, messages can be automatically rerouted via surviving stations.

Initial deployment began in the mid-1980's and continued for several years. Currently, additional spares and other support items and services are being provided.





and installed the Electronic Computer-Originated Mail (E-COM) system for the US Postal Service in 1982, permitting highspeed electronic mail processing for 25 cities

in America.

1) RCA Camden

designed, integrated

- 2) In 1984, RCA GCS, Camden, NJ was awarded a \$97 million contract to design, build and install a nationwide, survivable emergency communications network for the US Air Force. Known as the Ground Wave Emergency Network (GWEN), the system consists of a series of low-frequency broadcasttype relay stations.
- 3) Shelterized relay nodes for the GWEN program, built by RCA GCS at a newlyconstructed facility in Mt. Laurel, NJ, 1985.



RCA Camden's High-Performance Recording Systems: Custom Products for Military and Space Programs

RCA had long been a recognized leader in the design and development of custom, highperformance recording systems. Since the 1940's, RCA Camden had made numerous contributions in the magnetic recording field to the commercial TV broadcasting industry.

Analog magnetic recording experience gained through commercial product developments was applied to numerous US Government programs, beginning in the 1950's. Precision radar recorder/reproducers for land, ship, submarine and aircraft systems were developed, constantly advancing the "state-of-the-art" in design, storage capacity and reliability.

As mentioned previously, significant achievements in spaceborne recorders were numerous. Beginning in 1960 with the first TIROS satellite, Camden-built high-performance recorders had flown on nearly all subsequent NASA meteorological satellites, establishing phenomenal longevity and reliability records. Recorders for scientific probes and manned flights included the Orbiting Geophysical Observatory, the Orbiting Astronomical Observatory, Project Gemini and the Skylab space station.

A high-performance, dual-channel wideband airborne video recorder/reproducer, capable of withstanding severe environmental conditions, was developed by RCA Camden in the late 1960's. Known as the AN/USH-17 (V), this system was built specifically for the US Navy's A-6C and A-6E family of carrier-based attack aircraft. Its mission was to record in-flight radar, forward-looking infrared radar (FLIR) and low-light-level television (LLTV). Designed for high reliability and maintainability, the AN/USH-17 has served faithfully since 1972. At the present time, over 300 have been delivered to the Navy.

An extension of the AN/USH-17 were the Advisor 62 and Advisor 152 recorders which were designed for the US Air Force. They were similarly packaged with extended bandwidth capability. To date, more than 70 of these units have been delivered.

With the advent of digital technology, RCA Camden continued to advance the state-of-the-art in recording data rates and packaging density. VERSABIT, a transverse scan system capable of recording 24 million bits per foot of tape, was developed for the Navy. Wideband digital video recorders were developed for the Earth Resources Technology Satellite (ERTS), later known as LANDSAT, beginning in the early 1970's. The



1

ERTS/ LANDSAT program was instituted to survey the earth by satellite, capturing data for such vital work as mapping the earth, detecting air and water pollution, spotting diseases in crops and forests, and locating potential sources of minerals.

In October 1974, the Recording Systems group of RCA Government Communications Systems, Camden commenced development of a spaceborne magnetic recording system for multiple spacecraft applications. Consisting of two compact pieces-an 8-pound, 225-cubic-inch Electronic Unit and a 7-pound, 135-cubic-inch Transport Unit-this unique recorder was designed for use with a wide variety of spacecraft. So flexible was the design, that NASA designated it the Standard Tape Recorder (STR). Beginning in 1978, the STR-108 has been placed into orbit aboard over 20 types of spacecraft, including the Nimbus-G, TIROS-N, SAGE, LANDSAT EXPLORER, Upper Atmosphere Research Satellite (UARS), the Mars Observer, and all seven National Oceanic and Atmospheric Administration (NOAA) satellites. Performance of the STR-108 to date has been almost flawless. Since the first unit was launched on Nimbus-G on October 14, 1978, 60 others have followed. A total of 1.97 million failure-free hours of performance have been logged by the STR-108 as of July 1991. RCA Camden's Recording Systems group was presented the NASA Group Achievement Award in 1989 in recognition of the STR-108 team effort and dedication on the TIROS and NOAA programs.

1) One of the most successful Government programs by the RCA Recording Systems group of Camden, NJ was the AN/USH-17, a high-performance wide band video tape recorder for the US Navy's A-6 aircraft. Since 1972, these highly reliable magnetic recorders have successfully supported carrier-based operations around the globe. To date, over 300 units have been delivered.

RCA Camden also began developing laser film image recorders and optical disk recorders in the late 1970's. An optical "juke box" laser playback and recording system capable of providing mass data storage was produced for NASA's Marshall Space Flight Center. Each of the system's 125 disks have a storage capacity of a 24-book set of the Encyclopedia Britannica.

Another major focus of the Recording Systems group was extremely wideband, highperformance digital recorders. Using High-Density Multitrack Recording (HDMR) techniques, the group produced a number of sophisticated systems for the US Government.

The Recording Systems group developed many of these complex systems with the assistance of RCA Advanced Technology Laboratories (ATL), which was colocated in Building #10, Camden until 1984. Advanced research and component development support was also provided by RCA Laboratories, Princeton, NJ and RCA Solid State Division, Somerville, NJ.

Pioneering advances in both analog and digital magnetic recording, as well as in laser/ optical recording continue to be made by this outstanding group today under GE's Government Communications Systems Department in Camden, NJ.





- 2) The STR-108 Standard Tape Recorder, developed at RCA Camden in 1974, has flown on over 20 NASA spacecraft since Nimbus-G in 1978. To date, nearly two million hours of failure-free performance have been logged by this versatile magnetic recording unit, earning the Camden team the NASA Group Achievement Award.
- 3) A leader in optical disk recording systems, RCA Camden produced the Advanced Optical Disk Recorder (AODR), a "juke box" archival mass storage unit for NASA's Marshall Space Flight Center. Each of the system's 125 disks have a storage capacity of a 24-book set of the Encyclopedia Britannica. Dan Siryj, recording engineer, was a key member of the development team.
- 4) Donna Hubbartt, RCA Recording Systems, with the Berger wideband digital recorder/ reproducer, 1986. This unique system achieves high performance via High Density Multitrack Recording (HDMR) techniques.



1

1) Chalie Schmidt (left) COMSEC programs manager, and Edy Mozzi, program manager, discussing the benefits of Large Scale Integrated (LSI) Circuits being used in next-generation secure communications equipment produced by RCA Government Communications Systems, Camden, NJ, 1980. In the background is an enlarged photo of a compact circuit board populated by 12 LSI chips, which replaced the older, less reliable wired circuit boards previously used.

RCA Camden's Communications Security (COMSEC) Programs

The changing world of communicationselectronics from analog to digital technology brought forth a new generation of industrial pioneers in the 1960's. RCA was among them, blazing new trails in research, development and production of devices and systems ranging from integrated circuits to large-scale computers.

A new activity in RCA Camden's Communications Systems Division, known as Digital Communications Equipment, was quickly becoming a leader in the field. In 1963, this group commenced development of specialized devices and equipment that would grow to become a major product line of RCA Government Communications Systems for the next two decades: Communications Security (COMSEC). These products encoded or scrambled voice or data transmissions to maintain security. At the receiving end, signals were reconstructed to their "clear" or uncoded form. Through the 1960's, this group designed, developed and produced a number of these systems for the US Government.

Over the next 20 years, several generations of COMSEC equipment were produced for a wide variety of Government applications, including aircraft, ships, defense systems, and tactical and strategic communications systems.

Beginning in 1979, RCA invested significant resources in its semiconductor operations, purchasing equipment to design and manufacture Large Scale Integrated (LSI) circuits. The application of LSI technology to COMSEC equipment allowed the Camden-based business to design and produce



2

smaller, lower power devices that were much more reliable and easier to maintain. Using LSI, fewer parts were required to manufacture COMSEC devices. High-volume production was made simpler, resulting in significant cost savings for both RCA and its customers.

By the mid-1980's, RCA Government Communications Systems had become one of the nation's leading suppliers of COMSEC equipment. Design of a new generation of secure telephones for Government and industry use led to a \$14 million contract in March 1985 for development of the Future Secure Voice System (FSVS), a telephone designed for protection against electronic eavesdropping. Following development, RCA Camden was awarded an \$85 million production contract in July 1986 for tens of thousands of such units for various Government Agencies. This newgeneration device, called the Secure Telephone Unit III (STU-III) Low Cost Terminal (LCT), is the size of an ordinary office telephone, incorporating significant breakthroughs in technology to dramatically reduce the cost, size and ease-ofuse over previous security equipment. Deliveries began in 1987, allowing the Government to begin fulfilling its plan to improve the security of US telecommunications.

Pioneering advances in secure telephones and other COMSEC equipment for the US Department of Defense, other Government Agencies and industry continue to be made today by the same talented group at GE's Government Communications Systems Department of Camden, NJ.





- 1
- 2) Clancy Smith, RCA Camden engineer (right), pointing out features of COMSEC equipment developed for the US Army's Mobile Subscriber Equipment (MSE) program to Major General Donahue, TRI-TAC program director, while engineer Lance Beden observes, October 16, 1981. RCA was subsequently awarded a major production contract by GTE, prime contractor on the Mobile Subscriber Equipment (MSE) program, to supply the necessary equipment to provide secure voice, data and facsimile communications for the next-generation Army tactical system.
- 3) Mike Kliedermacher (right), RCA Camden COMSEC program manager, handing a handset for MSE communications terminal to Major General Donahue for a demonstration of the COMSEC features provided for the Army's newest tactical communications equipment, October 16, 1981.



- 4) Lieutenant General Lincoln Faurer (USAF) (third from right), Director of the National Security Agency, viewing a demonstration of secure telephone equipment being produced for numerous agencies of the US Government in the modernized production area, Building #17-3, Camden, NJ, May 19, 1983. Accompanying General Faurer were Joe Pane, division vice-president and general manager, RCA Government Volume Production (immediate left); Don Parker, director, Digital Communications Systems, RCA Government Communications Systems (immediate right); and Joe Christopher, manager, RCA Camden plant operations (far right).
- 5) RCA Government Communications Systems was awarded an \$85 million contract in 1986 to produce the STU-III Low Cost Terminal, an office-type telephone incorporating COMSEC technology to protect users from potential electronic eavesdropping. Production of this low-cost, full-featured unit began in 1987 and tens of thousands have since been produced for the US Government and industry.

RCA Camden's Information Processing Systems Programs

The last major government communications business that evolved from RCA Camden's digital signal processing development efforts of the early 1960's was Information Processing Systems (IPS).

Starting with a US Government contract in 1960, a select group of engineers, program managers, technicians, and production and support personnel began developing specialized equipment for the collection, location, processing, analysis, storage and dissemination of information. From customized digital signal processing circuit boards to large-scale integrated systems, this group provided numerous advanced solutions to difficult problems presented by a variety of specialized customers.

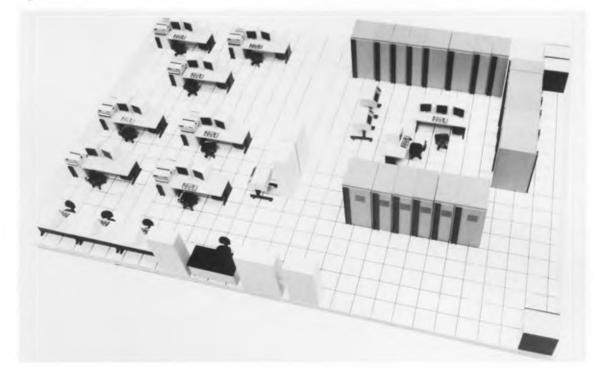
Applying skills in requirements analysis, systems definition, software engineering, systems engineering and integration, and integrated logistics support, the unique team of RCA Camden's IPS group made several significant contributions to the US Government in support of national security over the last 30 years.

This group of talented and dedicated personnel continues to provide high-technology systems engineering solutions today as part of GE's Government Communications Systems Department, Camden, NJ.





- 1) This dual-screen, computerized operator console, developed under a multi-million dollar program by the IPS group of RCA Camden from 1974 to 1980, was a fine example of human factors engineering. Hundreds were produced and delivered to the US Government. It became the standard console for many applications.
- 2) Sophisticated, rack-mounted information processing systems, mounted in transportable shelters, were among the many customized systems solutions provided by the systems design, engineering and integration team of RCA Camden's IPS group in the 1970's and 1980's.
- 3) Under a multimillion dollar, eightyear effort to upgrade a worldwide mission management system for the US Government, the IPS group designed, developed, and is currently producing a next-generation, automated network, consisting of userfriendly, state-of-the-art workstations, automated processing hardware and commercially-available software. IPS is providing a superior systems engineering solution to a highlycomplex requirement.



Other RCA Aerospace and Defense Highlights

The achievements by RCA Government
Communications Systems (GCS), Camden, NJ for
US Government aerospace and defense programs
in the 1968-1985 period exemplified the
corporation's expertise in advanced electronics in
support of our nation's security. Equally important were the numerous contributions made by
RCA's Astro-Electronics Division (AED),
Princeton, NJ; Missile and Surface Radar Division
(M&SRD), Moorestown, NJ; and the Automated
Systems Division (ASD) Burlington, MA. The
combined achievements of these three businesses
from 1968 to 1985 would require a separate
volume to fully describe. The following is a brief
summary of only a few major milestones.

RCA Astro-Electronics Division

As the nation's leading developer of meteorological satellites, RCA Astro-Electronics Division (AED) introduced a second-generation system designed to provide greater coverage of the earth's weather phenomena at lower cost than previous satellites in 1970. Known as the TIROS M, or Improved TIROS Operational System (ITOS-1), it was launched on January 23, 1970 and began supplying excellent day and night cloud-cover photographs every 12 hours. A second ITOS spacecraft, launched on December 11, 1970, was named after and operated by the National Oceanic and Atmospheric Administration (NOAA). NOAA was created as a new unit of the US Department of Commerce to consolidate activities of the Environmental Science Services Administration (ESSA) and several other Government agencies concerned with the environment.

NOAA-2, the first of a series of six new RCA AED-built satellites that provided the first operational three-dimensional information on the world's weather, was launched on October 15, 1972. Although similar in appearance to previous ITOS satellites, NOAA-2 carried heat-sensing infrared instruments in place of television systems. These remote infrared instruments included a Very High Resolution Radiometer (VHRR), a Vertical Temperature Profile Radiometer (VTPR) and a Scanning Radiometer (SR). The VHRR, developed by RCA for NOAA and NASA, produced high resolution weather data useful for fisheries, pollution control in bays and estuaries, and for hydrologists to make reliable assessments of potential flood areas. The VTPR measured infrared energy to calculate the vertical temperature distribution of the atmosphere

beneath the satellite. The SR took cloud cover pictures in both the visible and near infrared spectral regions.

NOAA-3, launched November 6, 1973 by NASA, provided the first direct global atmospheric temperature soundings to nations around the world. It became the primary worldwide weather-watching system. The next ITOS-series satellite, NOAA-4, was launched on November 15, 1974 and successfully carried two other systems into orbit: Spain's first scientific satellite (INTASAT) and a US amateur radio relay satellite (AMSAT). This project was succeeded by NOAA-5, launched by NASA on July 29, 1976.

Another RCA AED development was the Return Beam Vidicon Camera, which flew for the first time on the Earth Resources Technology Satellite (ERTS) in 1972 and produced excellent high-resolution multispectral pictures.

On December 15, 1973, RCA AED's first in a series of three Atmosphere Explorer satellites was successfully launched to probe a region of the upper atmosphere known as the thermosphere. The system investigated the atomic and molecular processes and chemical reactions that could affect weather and the environment on earth. The information was beamed back to earth, processed by NASA's Goddard Space Flight Center, and distributed in near real-time to scientists at universities and research centers throughout the US. The success of this program, called Atmosphere Explorer-C (Explorer 51), was followed by systems D (Explorer 54) and E (Explorer 55), launched October 6 and November 19, 1975, respectively.

Another scientific satellite program by RCA AED was Dynamics Explorer. Two of these spacecraft were launched side-by-side in 1981 to study the interactive coupling between the earth's magnetosphere, ionosphere and plasmasphere.

RCA AED also built a series of three satellites which provided US Navy ships at sea the most accurate navigational aid in history: Transit 18 (1968), Transit 19 (1970) and Transit 20 (1973). A new generation of RCA AED-built Nova navigation satellites were launched for the Navy in 1981 and 1984.

The Astro Division continued its strong reputation in weather satellites with the production of additional Nimbus and Landsat systems. These included Nimbus 3 and 4 (launched 1970), Landsat 1 (1972), Nimbus 5 (1972), Nimbus 6 (1975), Landsat 2 (1975), Landsat 3 (1978), Nimbus 7 (1978), Landsat 4 (1982) and Landsat 5 (1984).

A third generation of operational meteorological satellites with four times the payload-carrying capacity of previous systems of this type, was produced by RCA AED, beginning in 1978. The first of these was TIROS-N, successfully launched on October 13, 1978. Between 1979 and 1984, AED built several advanced TIROS-N satellites for NOAA.

RCA AED was also responsible for the Defense Meteorological Satellite Program (DMSP), one of the most successful and cost effective satellite projects of the US Air Force. From the first launch of DMSP-1 on September 16, 1966, the AED-supplied systems have continuously provided global and tactical weather data to tri-service users for 25 years. By 1984, 23 satellites in the DMSP series had been successfully orbited by the Air Force.

An RCA AED communications subsystem was aboard the Viking 1 spacecraft, which was launched on August 20, 1975 and touched down on July 20, 1976 on Mars. The RCA radio equipment began immediately transmitting scientific information and pictures back to earth some 225 million miles away. The same RCA equipment was aboard Viking 2, which was launched on September 9, 1975 and landed on Mars September 3, 1976.

RCA AED Closed Circuit Television (CCTV) camera systems were provided for NASA Space Shuttle missions, beginning in 1978. The system assisted Shuttle crews in performing the complex tasks of deploying, retrieving and servicing spacecraft in orbit.

RCA's domestic communications satellite system (Satcom) began in 1975 with the launch of Satcom 1. This was followed by Satcom 2 (1976), SATCOM 3R (1981), and Satcom 4 (1982). Advanced RCA Satcoms, equipped with highly reliable all solid-state power amplifiers, were introduced in 1982. These included Satcom 5 (1982) and Satcom 1R and 2R (1983). The RCA Satcom system is described in more detail later in this chapter.

By 1984, RCA AED had begun work on a new Ku-band satellite, the first two of which were launched by 1986. Four dual-band Spacenet communications satellites were also built for GTE Spacenet Corporation. Spacenet 1 and 2 were successfully launched in May and November 1984, respectively. Also for GTE, RCA AED produced four Ku-band GSTAR communications satellites. The first two were successfully launched in 1985 and 1987, respectively.

RCA Missile and Surface Radar Division

Since the opening of the Moorestown, NJ facility in 1953, RCA Missile and Surface Radar Division (M&SRD) had been a leader in a wide range of electronic defense systems for the US Government and the international marketplace. The division's expertise included major systems management, hardware production, systems integration and world-wide field support of radar systems.

Important RCA M&SRD programs in the 1968-85 period included: tactical land-based and shipboard gun fire control systems; activities relative to ocean surveillance, surface ship torpedo defense and target identification for undersea warfare; test range phased array threat simulation radars; and precision tracking instrumentation radars.

In 1969, RCA M&SRD was selected to develop the Aegis combat system for the US Navy's cruiser class ships. The \$253 million contract was the largest for RCA in more than 10 years. Developed throughout the early 1970's, Aegis became the first US Navy system able to automatically search, detect and track multiple targets and to fire missiles. The heart of the Aegis system was the AN/SPY-1 phased array radar which simultaneously detected and tracked numerous targets. Initially installed on the USS Norton Sound, the system detected, tracked and destroyed its first target drone in May 1974.

In 1976, RCA M&SRD was awarded a second-phase \$160 million Navy contract for development of a Combat System Engineering Development (CSED) prototype. The CSED prototype was built as an operational replica of a cruiser deckhouse, atop a building in a cornfield adjacent to the Moorestown plant. This "shipon-shore" installation has served to validate subsequently-developed Aegis systems and provide a crew training site for US Navy instructors.

RCA's dual role on the Aegis program was unique. The corporation was the first independent contractor to be selected by the US Navy to perform systems engineering for a total ship combat system. It was also the first prime contractor selected to develop, produce and test a complete US Navy weapon system.

The first Aegis-equipped ship to join the fleet was the *USS Ticonderoga* CG-47, commissioned January 22, 1983. Deployed with a carrier battle group in the Eastern Mediterranean during the 1983-84 Lebanese crisis, the Aegis

1) After 15 years of producing the Aegis combat system for US Navy CG cruiser class ships, RCA M&SRD was awarded a 1984 contract to develop and produce Aegis for the DDG guided missile destroyer class ships. The lead ship of this class was the Arleigh Burke DDG-51, pictured here firing its first missile during sea trials in early 1991. The Arleigh Burke was commissioned on July 4, 1991. Courtesy: GE GESD.

weapon system's exceptional capability was clearly demonstrated. The next cruiser class ships commissioned with Aegis systems were the *USS Yorktown*, CG-48 (July 4, 1984) and the *USS Vincennes*, CG-49 (July 6, 1985).

In 1984, RCA M&SRD was awarded a Navy contract to design and develop the Aegis combat system for the DDG-51 class of guided missile destroyers. The lead ship of this class, the *Arleigh Burke*, was commissioned July 4, 1991.

As of August 1991, 19 US Navy cruiser class ships, equipped with the Aegis combat system, have been commissioned and deployed to the fleet.

Another major product line of RCA M&SRD was instrumentation radars. Beginning with the installation of the first precision monopulse tracking radar, the AN/FPS-16 (XN-1) at Patrtick AFB, FL in 1957, the division had designed and produced a family of more than 100 instrumentation radars of ever-increasing sophistication and capability through 1985. The

AN/FPQ-6 and AN/TPQ-18, designed and built in 1961, were still being used by the US Air Force and NASA at sites around the globe in 1985. The AN/MPS-36, developed for precise, direct measurement of velocity as well as trajectory of missiles, re-entry vehicles and aircraft, was the first instrumentation radar capable of direct measurement of a target's radial velocity as an integrated part of system design. M&SRD also produced the AN/TPQ-39(V) Digital Instrumentation Radar (DIR), a high-mobility, computer-controlled system designed for operation and maintenance by a single person. The AN/TPQ-39(V) was deployed to Air Force, Army and Navy sites in the US and in the Federal Republic of Germany.

In 1984, RCA M&SRD won a \$53 million US Army program to develop and produce three phased array Multiple Object Tracking Radar (MOTR) systems for the White Sands Missile Range, NM. The MOTR system represented the next generation of sophisticated precision instrumentation radars for test ranges, with a capability to track up to 10 objects simultaneously.

Other RCA M&SRD programs during the 1968-1985 period included: the R76 multimode fire control system for land-based and shipboard applications; the Modular Airborne Search Track Radar (MASTR), a low-cost airborne radar; the AN/PPS-12 hand-held tactical radar system for the US Air Force; and a series of antenna programs. In the latter category, RCA M&SRD designed and produced a prototype SHF antenna for the US Air Force Advanced Airborne Command Post program. The division also produced antennas for the Apollo rendezvous radar; the Apollo S-band, moon-mounted umbrella communications antenna; and the Viking spacecraft communications antenna, deployed to Mars.

Since 1959, RCA M&SRD had been deeply involved in the Target Resolution and Discrimination Experiments (TRADEX) program. At a facility built and installed by the RCA Service Company in the Kwajalein Atoll, M&SRD systems provided detailed observations of long-range missiles fired from the west coast of the US.

RCA M&SRD's total capabilities in design, development, production, test and deployment of radar and other defense electronic systems, coupled with a solid foundation in hardware and software development and microelectronic technology expertise, made this division of RCA a world-class leader in its field.



RCA Automated Systems Division

The 1968-1985 period at RCA's Automated Systems Division (ASD), Burlington, MA was highlighted by expansion of its automatic test systems product line and major growth in command, control, communications and intelligence (C³I) and vehicle test systems programs.

Building upon its early successes in automatic test systems in the early 1960's for the US Army, ASD developed a new-generation, computer-based system in the 1970's. Known as Electronic Quality Assurance Test Equipment (EQUATE), it performed diagnostic, fault isolation and performance tests on a wide variety of military electronic systems - from AN/PRC-77 backpack radios to major subsystems of the Army's AH-64A advanced attack helicopter. Designated the AN/USM-410 by the US Army, EQUATE became the standard automatic test equipment for intermediate and depot-level electronic repair units. Through 1984, 145 AN/USM-410 shelter-mounted, transportable systems were on order by the Army, with 114 delivered.

From 1973 to 1978, ASD applied its skills in automatic test technology to the RCA M&SRD Aegis program by providing the Operational Readiness Test System (ORTS). ORTS was developed to determine the operational readiness of Aegis, at both the system and subsystem levels; to evaluate the system's performance, and to automate and centralize maintenance functions for easy use by the system operator.

In the mid-1970's, RCA ASD began to develop Simplified Test Equipment for Internal Combustion Engines (STE/ICE), entering the vehicle test systems business. STE/ICE carried out a series of over 50 tests, including those for engine power, compression and balance, on 15 different types of military vehicles. The system produced a substantial reduction in maintenance time, while significantly improving the accuracy of vehicle diagnosis. ASD subsequently produced over 7,000 STE systems for use on the Army's armored personnel carriers, trucks, jeeps, selfpropelled howitzers, the M1 Abrams Tank and the M2/M3 Bradley Fighting Vehicle. The STE-M1/ FVS, the version built for the M1 Abrams Tank, tested both the vehicle's electronic and mechanical systems. This pioneering achievement earned ASD the David Sarnoff Award for Outstanding Technical Achievement in 1980.

A notable 1974 development was a handheld laser system that accurately determined the range of a military target within one second. Designated the AN/GVS-5, nearly 7,000 of these lightweight (five pounds), inexpensive devices were ordered by the Army over the next decade. ASD received the David Sarnoff Award in 1978 for its fine efforts on this program.

The AN/GVS-5 was but one of RCA ASD's C³I products. Another successful program, initiated at RCA GCS, Camden, NJ and transferred to ASD, was the Remotely-Monitored Battlefield Sensor System (REMBASS). Consisting of a series of magnetic, seismic/acoustic and infrared sensors, radio repeaters and portable monitoring subsystems, REMBASS was developed for remote detection of persons and vehicles. The unattended sensors were designed for either hand or artillery-delivered emplacement in the ground. Initial development for the US Army was very successful. ASD received a \$37 million production contract in 1985.

Another large C³I program at ASD, begun in the mid-1960's, was the AN/TSW-7 and 7A mobile air traffic control system. The system, containing three controller stations, full HF/VHF/UHF communications and weather data collection capabilities, was designed for setup in only 30 minutes. Over 40 AN/TSW-7 and 7A systems were produced collectively for the US Army, Air Force, National Guard and overseas customers.

The largest C³I program at RCA ASD was the AN/TSQ-130 Technical Control and Analysis Center (TCAC), a mobile center which provided battlefield commanders the first automated management capability of tactical resources. First fielded to the US Army in 1983, TCAC became the critical node for tactical intelligence and electronic warfare operations at Army Divisions and Corps in the US, Federal Republic of Germany and Korea.

By 1984, RCA ASD continued to expand its leadership role in the markets of automatic test, vehicle test and C³I systems, with over 100 contracts at its Burlington, MA headquarters.

RCA Aerospace and Defense: Other Organizational Developments (PRICE Systems, SSTC, ATL and GVP)

The RCA organization for aerospace and defense business included several units besides the product lines divisions of GCS, Camden, NJ; AED, Princeton, NJ; M&SRD, Moorestown, NJ; and ASD, Burlington, MA.

In August 1975, RCA established a new business unit in Mt. Laurel, NJ to market its

proprietary cost estimating model which was originally developed for internal use in the early 1960's. Known as PRICE (Programmed Review of Information for Costing and Evaluation), this family of computerized, parametric cost estimating models was offered to both Government and commercial subscribers. The six models were designed to estimate costs for engineering, manufacturing and life cycle support for electronic, mechanical and electromechanical systems while these systems were still in the conceptual development stage.

RCA PRICE Systems offered training courses for analysts, beginning in 1975. By the mid-1980's, approximately 300 students per year were being trained on PRICE models at the Mt. Laurel facility. Recognized internationally as the aerospace and defense industry leader in parametric cost estimating models, PRICE was in use by more than 80 domestic and international companies and government agencies.

In 1983, RCA's Solid State Technology Center (SSTC), Somerville, NJ, was transferred to the Aerospace and Defense Group from the Solid State Division in recognition of the importance of advanced solid-state technology in space and defense systems. SSTC provided support for various programs, including the Aegis combat defense system at M&SRD, automated test systems at ASD, and secure communications systems at GCS.

Another new business unit, Government Volume Production (GVP), was established at the Camden, NJ plant in January 1983 to provide high-volume, reliable build-to-print equipment production for RCA's government programs. Major programs assumed by GVP were communications security (COMSEC) equipment and transportable, ground satellite communications terminals, both developed by the co-located GCS division.

RCA Advanced Technology Laboratories (ATL) began at the Camden plant in the early 1930's as a small group involved in sound motion picture technology. As RCA's defense electronics business grew, so did ATL—to support advanced engineering development work for Government programs. By 1979, ATL comprised a professional staff of about 100. The organization, headed by Fred Shashoua, was aligned by broad disciplines rather than by product lines. Five smaller units made up ATL at this time: the Digital Systems Laboratory, managed by Bud Kaiser; the Signal Processing Laboratory, headed by Monroe Howell; the

Image Technology Laboratory, run by Jack Rudnick; the Applied Physics Laboratory, managed by Dick Kenville; and the Very High Speed Integrated Circuits (VHSIC) Laboratory, under the direction of Jim Saltz.

About two-thirds of ATL's operating funds came from Government contracts, either directly or as subcontracts to the supported RCA defense business divisions. Close liaison was maintained between ATL, SSTC and the RCA Laboratories in Princeton, NJ to better exploit the latest research and support the product divisions.

By 1984, ATL's organization had grown significantly. A new 75,000-square-foot facility in Moorestown, NJ, dedicated in April 1985, became the new home for ATL's 250 personnel. Here, advanced development work in solid-state devices, sensors, laser recording, computer architectures, electro-optics, software, integrated circuits, applied physics, artificial intelligence, and other emerging technologies continued in support of RCA's defense products divisions and various Government customers.

RCA Aerospace and Defense Organization in 1985

On April 1, 1985, RCA announced a realignment of its organizations involved in aerospace and defense activities. The new organization, RCA Aerospace and Defense, replaced the former RCA Government Systems Division. John D. Rittenhouse, formerly Group Vice-President, RCA Electronic Systems and Services, was appointed Executive Vice-President, RCA Aerospace and Defense by RCA President and CEO Robert R. Frederick.

The new RCA Aerospace and Defense organization consisted of five divisions: Astro-Electronics, Princeton/East Windsor, NJ; Automated Systems, Burlington, MA; Missile and Surface Radar, Moorestown, NJ; Broadcast Systems, Gibbsboro, NJ; and Government Communications Systems, Camden, NJ. The Government Volume Production activity at the Camden plant was renamed the Electronic Fabrication Center (EFC) and became part of the new organization. Heading the various divisions were the following Vice-Presidents and General Managers: Charles A. Schmidt, Astro-Electronics; Andrew T. Hospodor, Automated Systems; William V. Goodwin, Missile and Surface Radar; Joseph C. Volpe, Broadcast Systems; Lawrence J. Schipper, Government Communications Systems; and Joseph Pane, Electronic Fabrication Center.

Other RCA Highlights: RCA Service Company

By 1969, the RCA Service Company had become one of the world's largest technical service organizations. At that time, it operated and maintained major electronic installations for the US Government at home and abroad: provided technical training, guidance and servicing for electronic data processing and other business and industrial equipment; installed and maintained RCA home instruments and institutional electronic systems; provided training for electronics technicians; and operated a Job Corps Training Center at Drums, PA for the US Office of Economic Opportunity and a special training center for the Bureau of Indian Affairs at Philadelphia, MI. The Government Services activity of the RCA Service Company was responsible for the operation and maintenance of the information gathering, data processing and communications systems for the US Air Force Eastern Test Range—the 10,000mile-long course along which missiles were launched from Cape Kennedy, FL. The Company also continued to operate and maintain the Ballistic Missile Early Warning System (BMEWS) sites in England, Greenland and Alaska, and provided extensive electronic services for the US Government at defense installations around the world.

In 1973, the Service Company celebrated its 20th year of service at the Air Force Eastern Test Range. The same support given to the Air Force at Cape Kennedy was provided to NASA for the joint US/USSR Apollo-Soyuz space mission in 1975. Also that year, the Company began supporting NASA's space research efforts at the Langley Research Center, VA.

Another RCA Service Company contract was started in 1975 with the US Department of Labor to operate Job Corps Centers in Astoria, OR and Tulsa, OK. The following year, it began operating another Job Corps Center in Baltimore, MD.

The Service Company was a leading supplier of television receivers to hotels, motels, hospitals and schools. It was also a major supplier of telephone systems to commercial customers, beginning in the early 1970's.

In 1970, the Company began to lease, as well as service, teletype equipment for both computing and communications uses. It also continued as a major supplier of installation and maintenance services for a variety of RCA products, including broadcast, theatre, marine radar and communications, mobile radio,

scientific, industrial and reservations systems equipment.

By the early 1980's, the Service Company had expanded it business activities in consumer, commercial, telephone and government markets, achieving new sales records annually. The organization had grown significantly, with 15,000 employees worldwide. Domestic operations were organized into three major divisions: Consumer & Commercial Services, Telephone Systems & Data Services, and Government Services. International divisions were also based in Canada and the United Kingdom.

Consumer Services had built a customer base of more than one million contracts for RCA home entertainment products and Whirlpool appliances. In 1983, Consumer Services began installing small earth stations and other equipment for the first US direct broadcast satellite (DBS) home TV service. The Commercial Services group began marketing a satellite TV receiving system and premium entertainment programming packages for hotels and motels that same year.

The Telephone Systems group installed its one millionth line in 1983, maintaining a leading position in the sale, installation and servicing of telephone interconnect systems. The Data Services group continued to enjoy increased sales and profits through its activities in the lease, installation and service of teleprinters and peripheral equipment. This group also maintained equipment for news, transportation and commodities services. It provided service on reservation, operating and security terminals for American Airlines; supported the Reuters and UPI news services; and provided on-site maintenance for Apple Computer's customers as an exclusive third-party supplier.

The Government Services group was involved in a wide variety of services for federal, state and local agencies by the mid-1980's. Activities were spread across such diverse areas as defense, education, research and the socio-economic field. Major military and space projects included the continued operation of the Air Force Missile Test Range; the Armament Test Range, Eglin AFB, FL; the Atlantic Undersea Test and Evaluation Center (AUTEC); the Atlantic Fleet Weapons Training Facility; the White Sands Missile Range; the Alaskan Aircraft Control and Warning System; various other projects for NASA and the Department of Defense; and several Job Corps Training Centers.

Other RCA Highlights - NBC

By 1967, color television had begun to reach millions of homes across America. NBC, the first full-color network, had arranged the first live color transmissions via satellite to England, extending the scope of color programming to international audiences.

From 1967 to 1970, NBC-TV was recognized with over 620 awards—including Emmy and Peabody Awards—the most received by any broadcasting organization. Among the major events covered by NBC News during this period were the Vietnam and Middle East Wars, the first manned landing on the moon and the assassinations of Dr. Martin Luther King and Senator Robert F. Kennedy. Memorable moments brought to America by NBC Sports included the major upset victories by the New York Mets in the 1969 World Series and the New York Jets in the 1970 Super Bowl.

NBC continued as a leader in the broadcasting industry from 1971 to 1976, winning 790 major awards and citations. This total included 152 Emmy and 26 Peabody Awards. Major NBC News events during this period included the end of the Vietnam War, President Richard M. Nixon's trips to the USSR and the People's Republic of China, the Apollo 15-17 moon landings, the US Senate Watergate hearings, the impeachment proceedings and subsequent resignation of President Nixon and the inaugurations of President Gerald Ford (1974) and Jimmy Carter (1977). Innovative programs introduced by NBC-TV during the 1971-1976 period included News Center 4 on WNBC-TV, New York; Weekend, a monthly TV news magazine; and NBC Saturday Night, a live, late-night comedy show, which debuted in the fall of 1975. NBC also devoted nearly 200 special programming hours to the celebration of the US Bicentennial in 1975-76, including a 10hour live telecast on July 4, 1976. The Fourth of July coverage was viewed by Americans coast-to-coast and by 13 foreign countries.

That same year, the nation's first national broadcasting service celebrated its Golden Anniversary. Commemorating this milestone, NBC instituted a new corporate identification program and aired a series of five network radio programs and a network TV special.

The years 1977-1984 were marked by a rapidly transformed broadcasting industry, brought about by the arrival of cable, pay-TV, an increasing number of independent stations and the advent of the home VCR. Although



NBC's revenues doubled between 1978 and 1981, profits declined. A significant portion of the loss was due to the cancellation of NBC's coverage of the 1980 Olympic Games in Moscow, which resulted from the US decision to boycott the event.

In June 1981, a new NBC management team, led by Grant A. Tinker, helped the company regain its competitive position. By 1984, the introduction of new hit shows such as *The A-Team* and *The Cosby Show* enabled NBC-TV to advance from third to second place in the prime-time ratings. From 1981 to 1984, NBC-TV led the networks in prime-time Emmy Awards, including 25 that it received for the hit drama series *Hill Street Blues*. In 1983, NBC signed a \$300 million, 10-year agreement with Comsat General Corporation, becoming the first network to use the superior-quality Kuband satellite for transmissions to its affiliates. The system was instituted in January 1985.

Two other highlights during this period were the introduction of the RCA Charge-Coupled Device (CCD) camera by NBC-TV, which provided superior low light and special effects capabilities; and the first network TV stereo broadcast on July 26, 1984.

1) The Cosby Show was introduced by NBC in 1984 and immediately hit the top 10 in national ratings. It has since become one of the most popular prime-time comedy shows in the history of television.

RCA Communications Services Activities: Globcom, Alascom, Americom, Satcom, Cylix and Network Services (1969-1985)

With the arrival of satellite communications in the 1960's, RCA's oldest business—communications services—expanded rapidly. RCA Communications, Inc. began providing telegram and telex service over the Early Bird satellite in 1965. The industry shifted more and more toward the use of telex and leased-channel services. In 1967, RCA introduced a new service called AIRCON, a remote computing application that allowed companies with private teleprinting networks to tie into a master computer for automatic message relays. In 1968, RCA offered its customers international voice, facsimile and data communications transmissions over the same link.

In 1969, RCA Communications, Inc. was renamed RCA Global Communications, Inc. (Globcom). Headquarters remained in New York City. That year, it began the Computer Telex Exchange, providing international telex communications within seconds at a low rate of error. Interpolated Voice Data, another service inaugurated that year, permitted simultaneous two-way voice and two-way data transmissions on the same circuit.

On June 25, 1969, RCA Globcom was selected by the US Government to purchase the Alaska Communications System from the US Air Force for \$28.4 million. The acquisition marked RCA's large-scale entry into the telephone business. RCA Globcom established a new subsidiary, RCA Alaska Communications, Inc. (Alascom), to operate the long-line network in America's northernmost state. By the end of 1970, RCA Alascom had already built a microwave system, a microwave and tropospheric link, and direct-dialing installations in Anchorage, Juneau, Fairbanks and Ketchikan.

On March 13, 1974, RCA Alascom announced that it had signed an agreement to build a \$30 million communications system for the Trans-Alaska oil pipeline, The agreement was made with Alyeska Pipeline Service Company, a consortium of 10 oil companies responsible for the design, construction and operation of the 789-mile pipeline. The system consisted of a primary system of overland microwave links and a backup satellite communications system. Microwave terminals and satellite earth stations were constructed at the Prudhoe Bay and Valdez locations, the beginning and terminating points of the pipeline. Others were built at strategic points in between.

In 1975, RCA Alascom began construction of 20 small earth stations to provide satellite



1) Technicians at the RCA Space Center, Princeton, NJ, inspecting Satcom I prior to delivery to Cape Canaveral, FL. Launched on December 12, 1975, Satcom I was RCA's first domestic communications satellite and, at that time, the most advanced of its kind in the world.

2) This giant antenna was one of six at RCA Americom's tracking, telemetry and command earth station located in South Mountain, CA.

communications services to isolated villages throughout Alaska. These stations went into operation one year later. RCA inaugurated the nation's first domestic satellite communications system in December 1973, using leased transponders on Canada's Anik II satellite, and later on the Westar II satellite.

On December 12, 1975, RCA designed, built and launched Satcom I, its first domestic communications satellite. It provided 24-channel service to Alaska, Hawaii and the 48 continental states. Satcom I was the most advanced domestic communications satellite ever launched at the time. RCA Satcom II was successfully launched on March 26, 1976. The first regularly-scheduled pay TV program service in America was carried by the RCA Satcom system in 1976.

To operate its domestic satellite system, RCA formed RCA American Communications

(Americom) as a new wholly-owned subsidiary in February 1976. It was headquartered in Princeton, NJ. By the end of that year, RCA Americom major earth stations were located near seven key US cities: New York, Philadelphia, Los Angeles, San Francisco, Chicago, Houston and Atlanta. Dedicated earth station service to NASA for the Viking Explorer mission to Mars and the Space Shuttle program also began in 1976. RCA Americom carried high-speed data and television transmissions for both programs.

As of August 1976, the RCA Communications group, headed by President H.R. Hawkins, consisted of five units. RCA Americom, Inc. was headed by President E.F. Murphy. RCA Alascom, Inc. was under President B.W. Agee. RCA Records Division, which had previously been moved under NBC in 1969, became the fourth unit of RCA Communications by 1976. The fifth unit was Random House, Inc.

On June 1, 1979, RCA Americom sold RCA Alascom to Pacific Power and Light, but continued to provide satellite control services within the state of Alaska and between Alaska and the rest of the US.

On September 28, 1978, RCA Globcom, Inc. announced its decision to donate 7,100 acres of undeveloped land on eastern Long Island to the New York State Department of Environmental Conservation. The gift included 5,100 acres at Rocky Point and 2,000 acres at Riverhead, some 60 to 70 miles east of New York City. The sites were originally acquired shortly after RCA's formation in 1919 and became the home of the transmitting and receiving stations for "Radio Central" in 1921. Having become obsolete, the dozen 410-foot long-wave antennas were demolished by December 1977. In accepting the 7,100-acre gift, Governer Hugh L. Carey announced that the land would become the foundation of a Pine Barrens Preserve, which covered the last remaining pure water supply in Nassau and Suffolk counties.

In 1978, RCA Globcom introduced the first high-quality, high speed international facsimile service, called Q-Fax, in concert with Kokusai Denshin Denwa (KDD) of Japan. This new service between the US and Japan made possible the transmission of all types of printed material in less than 30 seconds. By 1984, this service was expanded to serve 28 overseas locations.

The RCA Communications group was formed into an overall subsidiary of the corporation in February 1981 to consolidate all telecommunications businesses. By this time, this organization consisted of RCA Globcom, Inc.,



3) The control console at RCA Americom's earth station, Vernon Valley, NJ, for monitoring communications traffic and spacecraft tracking, 1976.

RCA Americom, Inc., and a new subsidiary, RCA Network Services, Inc. The latter activity was established to develop new domestic services and to manage the RCA corporate telecommunications system.

This new organization, RCA Communications, Inc. (same name as the former international operation from 1929 until 1968), became the overall responsibility of Executive Vice-President Julius Koppelman. E.F. Murphy became Group Vice-President of the new RCA Communications, Inc. A.F. Inglis continued as President of RCA Americom, Inc. and also became President of the new RCA Network Services, Inc. V.F. Podmolik became President of RCA Globcom, succeeding E.F. Murphy.

The final addition to RCA Communications, Inc. was Cylix Communications Network, Inc. a privately-held firm acquired on October 1, 1982 for \$30 million. The company became known as RCA Cylix Communications Network, Inc. It was headquartered in Memphis, TN and provided "value-added" data communications services through the use of high-speed computers and a domestic satellite network. E.F. Murphy became Chairman of the Board of Cylix and R.R. Johnson was elected President and Chief Executive Officer.

By 1985, RCA Communications, Inc. had became one of the nation's leading domestic and international satellite service organizations. RCA Globcom offered services to more than 240 countries worldwide. RCA Americom, carrying 12,500 private leased channels on the RCA Satcom system, was the top domestic satellite carrier for these services. The company's government services network had grown to 44 antennas at 37 locations and its commercial services network was reaching 16 major metropolitan areas, from Boston to Honolulu.

Other RCA Highlights: Consumer Electronics Division

The years 1968-1985 were marked by significant achievements by RCA's Consumer Electronics Division (CED) in color television, video cassette recorders (VCR), broadcast stereo and advanced audio/video products.

In 1968, RCA began incorporating solidstate components in its color TV sets for the first time. In 1971, RCA CED introduced the XL-100 series, the broadest line of color TV receivers with a 100-percent solid-state chassis in the industry. By 1974, RCA became the first full-line US manufacturer to devote its TV production exclusively to 100-percent solid-state receivers. ColorTrak, an advanced XL-100 model featuring improved circuitry and a higher quality picture tube, was introduced by RCA CED in 1975. Within a year, this successful product accounted for 42 percent of RCA's total color TV sales. In 1977, RCA announced the XtendedLife TV receiver chassis, named for its extended potential operating life resulting from reduced operating power requirements. By mid-1978, all RCA color TV receivers utilized this energy-saving chassis. RCA CED also introduced large-scale integrated (LSI) circuits in its ColorTrak receivers in 1978, eliminating the need for manual fine tuning. Known as ChannelLock, this tuning system incorporated a precision quartz crystal to automatically lock in the exact station frequency.

In 1980, RCA CED began selling a line of high-technology color TV monitor receivers designed for use with VCR's. The following year, RCA entered the projection TV market, offering its first large-screen systems. In 1984, the first RCA TV receivers with a built-in stereo broadcasting capability were introduced. That same year, RCA CED offered the first fully-integrated, audio/video entertainment system to American consumers. Known as Dimensia, this revolutionary system featured full control of each component from a single remote control device.

RCA entered the VCR distribution business in 1977, marketing a new line of home and portable recorders and color cameras. The 2.2-pound "Small Wonder" was a popular portable videotape camera with American consumers.

In March 1981, RCA introduced the SelectaVision VideoDisc system, a playback-only video system using 12-inch disks. The result of over 15 years of research, this high-technology consumer product was introduced to the market at the time when VCR's were becoming popular.

Since the VCR offered the added capability to record video programs, either directly from TV receivers or with a home camera, it became the system of choice. As a result, RCA VideoDisc sales eroded rapidly. Production of VideoDisc players ended in 1984, but the company continued to manufacture the disks for a short time longer.

RCA CED's operations in 1985 were located at Indianapolis and Bloomington, IN; Mocksville, NC; Juarez and Torreon, Mexico; and El Paso, TX.

Other RCA Highlights: Picture Tube Division

In 1939, RCA began production of the first black-and-white TV picture tubes in the US. For the next three decades, millions of these tubes were manufactured for the domestic and international markets. With the growth of color TV in the 1960's, demand for black-and-white picture tubes began to decline. RCA eventually ceased production of black-and-white tubes in 1977, but continued as an industry leader in color picture tubes.

The RCA Picture Tube Division (PTD) was formed in 1975, following the dissolution of the Electronic Components Division at Harrison, NJ that same year. RCA PTD continued to keep pace with the domestic and international markets. It had begun development of a 25-inch, 110-degree delta color picture tube in 1971 for the international market.

The first models were introduced to the European market in 1975 and, within a year, were selling well.

In 1979, RCA celebrated two milestones. First, the corporation's 100 millionth picture tube was produced. Second, it was the 25th anniversary of the RCA shadow-mask tube.

In 1982, the corporation reasserted its technical leadership with the announcement of the COTY-29 program (Combined Optimum Tube and Yoke), an improved, 29-inch color picture tube with a miniaturized yoke which was less costly to manufacture. The COTY-29 soon became an industry standard. The COTY-FS (Full Square) tube, featuring a rectangular screen for a larger viewing area, debuted in 1983. The COTY-SP (Square Planner), announced in 1984, featured a nearly planar screen edge and a much flatter faceplate. The COTY tubes represented the first major industry change in TV screen size and format since the early 1970's.

RCA PTD manufactured its products at plants in Lancaster and Scranton, PA; Circleville, OH; Marion, IN; and Midland, Canada in the

early 1980's. The Midland plant was closed in 1982, due to overall declining profits within PTD. The profit loss was the result of both a domestic economic recession and a worldwide overcapacity of color TV tubes.

The Picture Tube Division was renamed the Video Component and Display Division in 1983, receiving a new charter to pursue sales of video display products to the computer and other industrial and commercial markets in addition to sustaining its traditional business. The new division's operations were located at Marion, IN; Scranton and Lancaster, PA; and Circleville, OH. A new line of black-and-white and color monitors was introduced to the computer market in 1984.

As of 1985, more than 40 million black-andwhite and 90 million color picture tubes had been produced and sold by RCA in the US and abroad—a noteworthy statistic on one of the world's pioneering companies in television.

Other RCA Highlights: Solid State Division

A pioneer in solid-state technology since the 1950's, RCA continued as an industry leader in semiconductor devices with several advances in the 1970's and 1980's.

The RCA Solid State Division (SSD) produced the industry's first practical complementary metal oxide semiconductor (CMOS) integrated circuit (IC) in 1971, and the first combination of metal oxide semiconductor (MOS) and bipolar semiconductors on a single IC in 1974. The following year, SSD announced 40 new IC's of its CD4000 series. This brought the division's total line of COS/MOS low power devices to 180 standard and 100 custom circuits. SSD also introduced COS/MAC, the industry's first COS/MOS microprocessor (the central processing unit of microcomputers), in 1975. That same year, RCA announced the industry's first silicon-on-sapphire (SOS) product, a random access memory.

Production facilities of RCA SSD were expanded significantly in the 1970's. A new semiconductor plant was opened in Belgium in 1971 to serve the European market. Another plant was added in Malaysia in 1974 for the East Asian market, and still another was started in Brazil in 1975 for the Latin American market. In 1976, the RCA plant in Palm Beach Gardens, FL, which had ceased commercial computer operations when RCA exited the business in 1971, was converted to a solid-state devices production facility for SSD.

The domestic economic recession in 1974-75, coupled with a worldwide overcapacity of semiconductor devices, resulted in a short-term profit loss at RCA SSD. As part of RCA's organizational realignment of 1975, the Industrial Tube Operation of the dissolved Electronic Components Division became part of SSD under the name of Electro-Optics and Devices. This Electro-Optics group focused much of its efforts on closed-circuit television (CCTV) for commercial and industrial markets, introducing two all-solid-state units in 1975.

The late 1970's and early 1980's were marked by RCA SSD's introduction of several IC's for applications ranging from television receivers to automotive fuel management systems. Simpler single-package IC's for TV receivers were first produced in 1977. The first commercially available automotive ignition control IC was introduced by RCA in 1981. A 1983 contract from Chrysler Corporation resulted in RCA SSD's production of microprocessors for the spark control computers used in 1985 model Chrysler vehicles.

Beginning in 1981, RCA entered a series of agreements and joint ventures with other semiconductor firms. The first was with Motorola, from whom RCA obtained the right to produce and sell an 8-bit CMOS microprocessor design. A 1982 agreement with Philips of the Netherlands resulted in joint development of high-speed CMOS logic chips, called QMOS. Alternatesource agreements with LSI Logic, Inc. were made in 1983 for custom gate arrays. Finally, a joint venture with Sharp Corporation of Japan was announced in 1984, whereby Sharp could design, develop and produce CMOS VLSI IC's in the US. These joint ventures showed that the semiconductor industry had become aware of the growing importance of RCA-invented CMOS technology. By entering these ventures, RCA SSD further solidified its position in the worldwide market.

By 1985, RCA SSD operations were located at Somerville, NJ; Mountaintop, PA; Findlay, OH; Palm Beach Gardens, FL; and Washington, DC.

Other RCA Highlights: New Products Division

In September 1983, RCA created the New Products Division (NPD) with headquarters in Lancaster, PA, to plan, develop, manufacture and market new electronic products. NPD was formed from the existing base business of Electro-Optics and Devices. The main business thrust of the new division was in closed-circuit television (CCTV) systems, which were sold to banks, supermarkets, department stores and Government installations for surveillance applications.

RCA NPD's Tube Operations was the world's largest manufacturer of Silicon Target Vidicons (called Ultricons), for use in CCTV systems. Other products included photomultiplier and high-resolution display tubes.

In 1984, NPD also assumed responsibility for development and production of RCA's charge-coupled devices (CCD), solid-state imagers designed for use in a new color camera which was planned for production by RCA's Broadcast Systems Division.

Other RCA Highlights: RCA Laboratories

RCA Laboratories (RCAL) continued its fine reputation as a world-wide leader in communications-electronics research throughout the 1968-1985 period. The Laboratories had grown to include international branches in Montreal, Zurich and Tokyo by the 1960's.

Pioneering efforts in laser technology led to development of a combined television and laser system for transmission and recording of images, first demonstrated by RCAL in 1967. TV images were sent to a gas laser, whose beam traced them on photographic film. That same year, another laser technique was developed for producing holograms of large stationary objects. In 1968, RCA took this research one step further, developing the world's first holographic computer memory. The first laboratory model of a laser-based home video player was produced in 1969. This model was the precursor to the RCA SelectaVision VideoDisc system, which eventually reached the market in 1981.

RCAL also pioneered liquid crystal display technology in the late 1960's. Using liquid crystals for electronic control of the transmission and reflection of light, RCAL's scientists envisioned applications ranging from automobile dashboards to flat-screen TV receivers. This technology has since been incorporated into watches, hand calculators and many other electronic instruments.

During the early 1970's, RCAL concentrated much of its efforts to supporting commercial product programs of other RCA divisions, including RCA Satcom, the ColorTrak TV receiver and the SelectaVision VideoDisc system. RCAL was also respon-

sible for pioneering research which led to the development of the charge-coupled device (CCD) image sensor, the industry's first COS/MOS microprocessor and the first silicon-on-sapphire (SOS) circuits. The research for all three breakthroughs was conducted between 1971 and 1974.

A major 1974 development at RCAL was an electro-optic modulator that could allow up to 5,000 persons to talk simultaneously over a single-laser-beam, high-grade telephone circuit. Another achievement in electro-optics research was the demonstration of a document reader which used a laser to electronically reproduce text and photographs suitable for facsimile transmission.

Throughout the late 1970's and early 1980's, RCAL continued to strengthen its relationship with the corporation's product divisions. To provide closer coordination, satellite RCAL units were set up at the Consumer Electronics Division, Indianapolis, IN, and the Video Component and Display Division, Lancaster, PA. Other notable researh efforts included development of high-definition television (HDTV) pictures compatible with NTSC broadcast standards and continued work on flat-screen TV.

In support of RCA's defense electronics businesses, RCAL assisted in development of an infrared, heat-sensing TV camera for the Automated Systems Division and continued to improve an optical disk mass data storage system for the Government Communications Systems Division.

Through 1985, RCA Laboratories continued to direct a major portion of its research toward the development of potential products for the corporation's core businesses in communications-electronics, making valuable contributions for products such as broadcast cameras, video components, monitors, satellite communications and optical recording systems.

Return to Core Strengths (1980-1985)

A formal plan to focus on electronics, communications, broadcasting and financial services was adopted by RCA in 1980, the year Edgar Griffiths became Chairman of the Board. Between 1980 and 1985, RCA sold nearly all non-traditional businesses. Random House, Inc. was sold to Newhouse Publications and Banquet Foods, Inc. was sold to Conagra, Inc; both in 1980. C.I.T. Financial Corporation was acquired in 1980 in an effort to stabilize RCA's historically



1) Robert R. Frederick, RCA President and Chief Operating Officer and Thornton F. Bradshaw, RCA Chairman of the Board and Chief Executive Officer, shown here in 1984. Bradshaw took the helm in 1981, succeeding Edgar Griffiths.

cyclical earnings pattern.

On January 24, 1981, Griffiths announced that he had asked to be relieved of his duties as Chairman and Chief Executive Officer.

Thornton F. Bradshaw, president of the Atlantic Richfield Company and an RCA board member since 1972, succeeded Griffiths later that year. That year, two of the corporation's longest running businesses had become non-competitive and were sold. Avionics Systems, headquartered at Van Nuys, CA, required significant investment to remain competitive and was, instead, sold to Sperry Corporation. This business began in the early 1930's at the Camden, NJ plant. Mobile Communications, which began in the 1920's was also sold in 1981.

C.I.T. Financial Corporation was sold to Manufacturer's Hanover in April 1984 and Hertz Corporation was bought by UAL, Inc. in 1985.

Robert R. Frederick, who became RCA President and Chief Operating Officer in 1982, took the helm as Chief Executive Officer in March 1985.

Financial Summary

From 1968 to 1985, RCA grew from a \$3 billion to a \$9 billion business. Despite a major period of diversification into nontraditional businesses, shifting business strategies, numerous organizational realignments, a series of corporate management changes, a severe domestic economic recession and a tremendous increase in world-wide competition, RCA returned to its core strengths in communications, electronics and entertainment and remained an industry leader in 1985. Major growth in aerospace and defense, satellite communications products and services. and television broadcasting and products highlighted this period of amazing technological achievement. In the course of 66 years, RCA had evolved from a \$2 million, 456employee service organization that sent messages across the Atlantic in 1919, to a \$9 billion, 88,000-employee international corporation that sent messages across the solar system.

Pardon our pride.

For generations GE and RCA have touched the lives of millions of people. We have embodied the creative spirit of America. Its technological greatness, scientific advances, dynamism and movement.

We have entertained America and defended it. Illuminated its homes and made its airwaves dance.

Above all, we have been a pulse of progress and free enterprise.

The planned merger of our two great companies is an event that makes us very proud. And equally optimistic.

We will be a company whose strengths will have profound and beneficial effects. A company that will compete with anyone. Anywhere. In every market we serve.

We are proud of the people who over the years have built our two companies into great organizations achieving modern-day miracles. And of the people who've worked so diligently to keep our companies great—through periods of economic difficulties and technological change.

We are two companies with proud pasts. We will become one company with an important future. For the people of this country and countless millions of others around the world.

All will benefit from our products, our services, and our capabilities.

That makes us especially proud.
And very





Chapter 10

GE and RCA: Reunited and Refocused for the Future

"Speed... simplicity... self-confidence are our keys to winning in the decade ahead, and we are committed to bringing the opportunity to possess these characteristics to every person in every corner of this enterprise."

> — John F. Welch, Jr. GE Chairman and CEO General Electric Annual Meeting of Share Owners, Greenville, SC, April 26, 1989

ecember 12, 1985 was a historic day in the US communications - electronics industry. The Boards of Directors of General Electric Company and RCA Corporation announced a definitive agreement to merge their assets and experience, creating a combined company that would successfully compete with anyone, anywhere, in every market served.

The merger, approved by RCA shareholders on February 13, 1986 and completed June 9, 1986, was the largest in US business history outside the oil industry. In the \$6.4 billion transaction, RCA and NBC became subsidiaries of GE, bringing these old partners full circle. The historic reunion came 54 years after the US Government had directed GE and RCA to separate and become competitors in the field of communications-electronics.

Both the US Justice Department and the Federal Communications Commission (FCC) reviewed and approved the 1986 merger. As a result of the Justice Department review, GE sold its vidicon tube business—one of the products manufactured at the Microwave Products Department in Owensboro, KY. The FCC's approval required GE to sell five NBC radio stations in New York, Chicago and Washington, DC—the cities in which NBC also had television stations. In accordance with a new FCC rule, a new owner could not own television and radio stations in the same market. The radio networks were sold to Westwood One, Inc. in 1987 and the radio stations were sold to several broadcasting companies in 1988-89.

The planned merger of GE and RCA, announced to share-holders on December 12, 1985, was revealed to the public in ads like this one, which appeared in The Philadelphia Inquirer on December 16, 1985.

Meanwhile, the integration of RCA, which had \$8.9 billion in sales and 88,000 employees in 1985, and GE, which had \$28.2 billion in sales and 304,000 employees in 1985, began immediately after completion of the merger. This integration of RCA and GE was based upon a business strategy begun by GE Chairman and Chief Executive Officer John F. Welch, Jr. upon his assumption of the position in 1981.

GE entered the 1980's as a company with almost \$23 billion in annual revenues, net earnings of \$1.4 billion, 405,000 employees, and nearly 350 businesses or product lines.

Growing competition from Japan created the need for GE to quickly restructure itself to become a leaner, more agile force to successfully compete in the world market. GE businesses were challenged to become numberone or number-two in their global markets. Those that could not were either fixed, closed or sold. Income generated from the sale of nonstrategic businesses was invested in remaining core businesses and used to acquire other strategic businesses. By the end of 1985, GE had become a streamlined company with \$28.2 billion in annual revenues, net earnings of \$2.3 billion, 304,000 employees and approximately 100 businesses or product lines. These businesses were grouped into three main categories: core manufacturing, technology and services.

The same strategy affecting changes at GE also applied to the RCA businesses following the 1986 merger. Those which were a strategic fit in core manufacturing, technology or services were integrated. Those which were not were divested. Coronet Industries, the non-traditional business which manufactured floor coverings, was sold. RCA Records, which had entered a joint venture with the West German media company, Bertelsmann, AG in 1984 to form RCA/Ariola International, was sold to Bertelsmann, AG in 1986. The Consumer Electronics businesses of both GE and RCA, which faced increasingly stiffer competition from Japan, Korea and Taiwan in the global market, were sold to Thomson, SA of France in 1987. RCA Global Communications (Globcom) was purchased by MCI Communications Corporation that same year. The Detek Corporation, a new company formed by members of RCA's New Product Division, purchased the division and the Lancaster, PA facility from GE in 1987. Also that year, GE donated the 350-acre David Sarnoff Research Center in Princeton, NJ to SRI International, a nonprofit world-wide research and consulting firm based in Menlo Park, CA. Under



the agreement, GE committed to fund approximately \$250 million in research contracts at the Center for a period of five years. In 1988, the Solid State Division was acquired by Harris Corporation.

Other RCA businesses that were a strategic fit were integrated into GE. NBC continued as an operating subsidiary and the leading US television network. RCA Licensing, based in Princeton, NJ was consolidated with GE's International Licensing Department in 1987 to form GE and RCA Licensing Management Operation, Inc. (GERLMO).

The RCA Service Company was merged into GE in 1986. The Consumer Service Division. responsible for RCA's television and telephone maintenance and sales business, was combined with GE's appliance services and moved from Cherry Hill, NJ to Louisville, KY. The Business Communications and Electronic Services Division, responsible for RCA's third-party maintenance services for computers, instruments and data communications equipment, was combined with GE's similar operations and moved to Atlanta, GA. The Government Services Division, responsible for RCA's educational and government services programs, became GE Government Services (GEGS) and remained at the Cherry Hill, NJ headquarters. RCA American Communications, Inc. (Americom), the commercial subsidiary which was operating seven orbiting Satcom communications satellites in 1987, became GE American Communication, Inc. that same year.

1) GE Chairman and Chief Executive Officer John F. Welch, Jr. (center), flanked by former Vice Chairman of the Board and Executive Officer Lawrence A. Bossidy (left) and Vice Chairman of the Board and Executive Officer Edward E. Hood, Jr. in 1988. Since taking the helm in 1981. Welch has streamlined GE into a world-class company of 13 top-notch global businesses that collectively generated \$58.4 billion in revenues and \$4.3 billion in net earnings in 1990.

The Formation of GE Aerospace

The defense businesses of RCA Aerospace and Defense (A&D) and GE Aerospace Business Group (ABG) were combined to form GE Aerospace, one of the foremost defense-electronics enterprises in the world today. RCA Astro-Electronics Division, a world leader in commercial weather and navigational satellites, was combined with GE Space Systems Division, Valley Forge, PA, a major producer of military satellites, to form GE Astro-Space. Headquartered in Princeton, NJ with operations in both Princeton and Valley Forge, GE Astro-Space is a global leader in satellite and spacecraft systems today.

RCA's Automated Systems Division of Burlington, MA was merged into GE's new Federal and Electronic Systems Division (FESD) in 1986, creating a combination of strengths in the extremely competitive automated test systems field. FESD was subsequently reorganized, and GE's automated test systems operations in Burlington and Huntsville, AL became part of GE's Aerospace and Electronic Systems Division (AESD).

RCA A&D's Advanced Technology
Laboratories (ATL) of Moorestown, NJ were
combined with GE ABG's Electronics Laboratory (E-Lab) of Syracuse, NY to form GE
Advanced Technology Operation (ATO). The
combination of ATL's signal processing,
artificial intelligence and systems applications
strengths with E-Lab's capabilities in electrooptics, microwave technology and circuit design
created a tremendous resource to support GE
Aerospace's operating divisions.

RCA PRICE Systems, which developed, maintained and marketed the PRICE family of computer-based cost estimating models, became GE PRICE Systems.

The creation of GE's Government Electronic Systems Division (GESD) in 1987 brought together into a single organization two of the nation's finest radar and sonar resources—the former GE Military Electronic Systems Operations, headquartered in Syracuse, NY and the former RCA Missile and Surface Radar Division, based in Moorestown, NJ.

Completion of the integration of GE and RCA defense businesses came with the formation of the Communications and Strategic Systems Division (CSSD). RCA Government Communications Systems Division of Camden, NJ became GE Government Communications Systems Department in 1989. The Camden group joined GE's Military & Data Systems



1



2

1) The Marketing Manager's staff of RCA Government Communications Systems Division, Camden, NJ in 1988 were (l-r): Daryl Hatfield, Information Processing Systems; Marty Karch, GWEN Program; Ray Shreve, Integrated Communications Systems; Winnie Kulka, secretary to Marketing VP Al Thompson (not pictured); Jack Banister, Transmission Systems; Tom Padden, Space Programs; and Tony Bartuska, Digital Communications and Recording Systems.

2) John D. Rittenhouse, Senior Vice-President, GE Aerospace (center) and Joseph B. Howe, General Manager, RCA Government Communications Systems Division (right), accepting the Toastmasters International Communications Achievement Award in October 1988 from Art Rimbach of the Camden-based Little Nipper Toastmasters Club. The Little Nipper Club was founded in 1959 to develop communications skills of RCA management personnel. Membership was later extended to all employees. The club's activities continue today at GE GCSD, Camden, NJ.

Operations of Valley Forge, PA and the Simulation and Control Systems Department of Daytona Beach, FL to form a single organization with unique capabilities in the design, development, production and integration of a wide variety of communications systems.

The 1986 addition of RCA Aerospace and Defense, a \$1.2 billion business with 14,000 employees, to GE Aerospace Business Group, a \$3.0 billion business with 36,000 employees, resulted in a combined \$4.2 billion operation with 50,000 employees. Since that time, streamlining changes have enabled GE Aerospace to become a world-wide leader in an increasingly competitive market. The business, which had \$5.6 billion in revenues and 38,000 employees in 1990, sustained leadership positions in its key markets despite a sixth straight decline in the US defense budget.

GE Today: A World-Class Leader in Manufacturing, Services and Technology

GE's view of the 1980's—that only businesses that were number-one or number-two in their markets could win in the increasingly competitive global arena—was consistent with moves made throughout the decade. After \$10 billion worth of divestitures and \$19 billion of acquisitions to strengthen its strategic businesses in core manufacturing, services and technology, GE today is a world-class company which, in 1990, had \$58.4 billion in revenues, \$4.3 billion in net earnings, 298,000 employees and 13 businesses at, or near, the top of their global markets.

GE's core manufacturing businesses today are: Appliances, Industrial and Power Systems, Lighting, Electrical Distribution and Control, Motors and Transportation Systems. GE Appliances is a global leader in major appliances for the home, providing top-quality products under the GE Monogram, RCA and Hotpoint brand names. Industrial and Power Systems is a world-wide leader in providing utilities and other customers with products that generate and deliver electricity as well as systems that improve air quality. GE Lighting, continuing the 113-year-old heritage begun by Thomas Edison with his invention of the incandescent lamp, is the world's largest supplier of light bulbs and a global leader in lighting technology today. GE Electrical Distribution and Control is an industry leader in products that distribute, control and protect electrical power and a supplier of factory automation equipment. GE Motors is the US

market leader in energy-efficient motors and one of the largest suppliers of AC and DC electric motors in the world. GE Transportation Systems is one of the world's largest manufacturers of diesel electric locomotives and a leading supplier of propulsion systems for rapid transit cars and electric wheels for off-highway vehicles.

GE's services businesses today are: Financial Services, Communications and Services, and NBC. GE Financial Services, one of the largest and most diversified finance companies in the US, provides financial products and services tailored to customer needs through GE Capital, Employers Reinsurance and Kidder Peabody. GE Communications and Services supports customers world-wide through several major activities: GE Information Services, a leading supplier of network-based information management services; GE Consulting Services, offering consulting and computer software services; GE Computer Service, providing electronic equipment service, rental and repair to Fortune 500 companies; GE Government Services, a leader in technical, scientific and engineering services to federal, state and foreign governments; and GE Americom, providing domestic satellite communications services. NBC, the top-ranked US television network in 1990 in terms of viewer ratings and advertising revenues, received 33 Emmy Awards that year for primetime news, sports and daytime programs.

GE's technology businesses today are: Plastics, Medical Systems, Aircraft Engines and Aerospace. GE Plastics is a world leader in high-performance engineering plastics for innovative applications such as replacing metal, glass and other traditional materials. GE Medical Systems is the global leader in diagnostic imaging systems used by hospitals, clinics and health care professionals to provide the best health care possible for their patients. GE Aircraft Engines is the world's leading manufacturer of large jet engines for commercial and military aircraft, and the supplier of both large and small engines powering nearly 18,000 aircraft in service today. GE Aerospace is a leading US supplier of satellites, radar systems, integrated software systems and other advanced technologies for defense, space and aviation applications.

These 13 world-class businesses are supported by GE International, which assists them in achieving leadership positions in established world markets and expanding into new and emerging markets.

GE in the 1990's: Setting the Pace in a Global Market

The restructuring and refocusing of GE in the 1980's resulted in a world-class company that successfully competed in both the domestic and international markets. However, the economic environment of the 1990's, marked by increasingly stiffer competition from Japan, Korea, Taiwan and a revitalized Europe, creates the need for further changes by GE to retain and enhance its position as a world-wide leader.

Understanding the need to move more quickly in everything it does, from product development cycles to responding to customers' needs, GE has instituted a process to achieve the necessary speed to successfully compete in the world market. This process, named "Work-Out," began in 1989. Patterned after the New England town meeting, GE employees from various disparate groups that previously had no occasion to communicate with one another during the work day-hourly, salaried, managers, union leaders-began to gather and share their ideas on ways to

improve the company. Workers at all levels now have a voice to affect change and help determine the future of GE. The Work-Out process, which has since become a corporatewide initiative, has generated ideas and suggestions ranging from abolishing needless paperwork to creating new cross-functional programs for improved internal productivity. Many of these ideas have since been implemented. By empowering its employees at all levels to help shape the company's future, GE has created a new sense of self-confidence which is spreading rapidly throughout its world-wide businesses. As that self-confidence continues to grow, so do trust and teamwork. Consequently, the traditional boundaries of bureaucracy are beginning to fall. By achieving its vision for the 1990's as a "boundaryless Company," GE is picking up speed, and with that speed, a competitive advantage.

As GE enters the uncertain world market of the 1990's, it does so with 13 confident, globally-positioned businesses-setting a pace which many of its competitors will find hard to follow.

1) In 1990, GE began construction of two world-class manufacturing centers to support its aerospace divisions by using innovative techniques and work practices to achieve maximum productivity. Called Regional Electronic Centers (REC), they are located in Conklin, NY and Bridgeport, NI to provide cost-efficient, centralized production of electronic equipment for the aerospace units throughout the New England and Mid-Atlantic regions. The Bridgeport facility, shown here under construction in November 1990 behind the project team of (l-r): T. Ellison, C. Finnegan, R. Eberwine and J. Boggi, was completed in 1991 and now supports GE Aerospace's businesses in Pennsylvania and New Jersey.



GE Camden: Today and Tomorrow

Since its integration into GE Aerospace as the Government Communications Systems Department (GCSD), the Camden-based business has continued to build upon its legacy of twentieth-century communications pioneering. As one of the first GE locations to implement the Work-Out process, GE Camden has begun to reshape its own business future in the global defense electronics market. Begun in August 1989 under the direction of Department General Manager Thomas A. Corcoran, energetic Work-Out teams gathered from all corners of the Camden plant to recommend and implement changes to help make GE GCSD the most famous name in government communications systems. William G. Gingrich, succeeding Corcoran as Department General Manager, built upon the Work-Out process. In September 1990, he challenged all employees to "Seize the Opportunity" by volunteering to tackle a series of 14 issues necessary for GE Camden to be a winner in the 1990's. Over 1,400 employees rose to the challenge, affecting changes ranging from reduced product cycle time to improved business pursuit processes. The positive results of these changes are being felt by GE Camden employees, their customers, and the company today in terms

of improved work practices, faster and higherquality product deliveries, and stable sales and earnings.

The GE GCSD "Open House," first in over a decade, was held on September 23, 1989. In keeping with the Camden plant's great heritage of accomplishment, the official theme for the day was "GCSD Pride '89 ... Past... Present and Future." Nearly 6,000 people gathered for a day filled with fun, food and entertainment as GCSD employees exhibited to their families the results of their talents and dedication. Demonstrations and displays of several developmental and production contracts for a number of exciting defense and space programs were held throughout the plant. Displays included "hands on" use of AN/STC-2 telephones, a simulated conning tower of the Trident submarine, videotapes of Space Station Freedom, demonstrations of voice encoding and decoding equipment, and a full scale prototype of the Integrated Radio Room (IRR), with explanations on how it supports the Trident mission. There was also plenty of food, carnival games for the children and a 25-piece Mummer String Band. The Open House, the product of many proud employees, helped to reinforce the fact that GE Camden is helping keep America in the forefront of the communications-electronics industry.

1) Tom Corcoran, who became Department General Manager of GE Camden in early 1989, embarked on a new plan which included open discussions with employees at all levels to improve communications throughout the GCSD organization. As part of this plan, Corcoran spearheaded one of GE's first "Work-Out" sessions in August 1989 (shown here) at GCSD, which stimulated new ideas to improve all facets of the business. As a result, employees from all corners of the Camden plant teamed up to recommend and implement changes which ranged from eliminating needless paperwork to reducing cycle times in producing and delivering products to its customers.









- 2) Art Glenn, Vice-President and General Manager, GE Communications and Strategic Systems Division (CSSD), communicating his message on performance management to tomorrow's leaders of GE GCSD, Camden, NJ in 1990.
- 3) On September 27, 1990, over 2,000 employees of GE's Government Communications Systems Department, Camden, NJ gathered at Garden State Park in nearby Cherry Hill, where General Manager Bill Gingrich requested their assistance in "Seizing the Opportunity." Gingrich asked for volunteers to tackle 14 major issues ranging from improving productivity and quality to outperforming the competition. Over 1,400 employees responded by joining teams and offering new ideas to improve GCSD and make it a winner in the 1990's.
- 4) Members of the GE Camden team responsible for production of the audio/visual presentation and coordination of the successful "Seizing the Opportunity" kick-off meeting on September 27, 1990, receiving the General Manager's Award for Excellence from Bill Gingrich (left) included (l-r): Fred Pschunder, Dawn Stevenson, Barry Lem, Cathy Stewart, Tom Levecchia, Val Deorio, Richard Templeman, Dennis Urban, Linda Dulye, Ray Meginnis and Tom Del Rossi. Not pictured: Eleanor Goodman and Joe Hassell.





- 1) GE GCSD "Seizing the Opportunity" Team #6 has been recommending solutions to improve the business pursuit process and develop new markets for the Camden-based business in the 1990's.
- 2) GE GCSD "Seizing the Opportunity" Team #14, responsible for finding ways to reduce costs while improving productivity, has recommended a series of changes which have been recently implemented and are positively impacting productivity at the Camden plant.
- 3) The mid-term progress reports by GE GCSD's 14 "Seizing the Opportunity" teams were attentively received by the Department's management staff in November 1990. Several team recommendations were immediately implemented, while others are being further investigated for future, long-term, implementation.





4) Members of GE GCSD's 1989 Open House Committee, which successfully executed the first event of its kind in over a decade, included (back row, l-r): Russell Cook, Patrick Kennedy, Dennis Urban, Mary Dattilo, John Heyl, (second row): Larry Cochran, Cheryl Weinberg, Rachel Taylor, Catherine Blackwell, Harry Rossini, Doris Peterson, Denise DiAngelo, (front row): John Vogel, Jim McColigan, John Fentress, Joan Bruce, Georgia Alexander, and Mae Pohubka.

The GE GCSD Open House held on September 23, 1989, the first in over a decade, was enjoyed by employees and family members alike. Nearly 6,000 attended the festivities, which included displays and demonstrations of a variety of current products and plant operations plus carnival games and musical entertainment. Some of the participants included: 1) Fred Barnum, his wife Marian and their twin girls April and Kimberly, shown here with his historical photo exhibit which was the inspiration for His Master's Voice in America; 2) The Phil Giordano Jazz Band; 3) John Tchou, his wife Anna and parents; 4) The GCSD cafeteria team (l-r) John Young, Arnell Miller, Alvin Winston, Eleanor De Masse, Debbie De Cosmo, Benito Gonzalez, and Orlando Caban; 5) George Chase, setting up a carnival game; 6) Maryellen Pignataro, her mom, husband Max and their children Kelly and Mike; 7) Milt Lowe, demonstrating telephones for the AN/ STC-2 program and 8) Larry Peterson and his son Shawn on a mock-up of the USS Ohio SSBN 726 Trident submarine.



















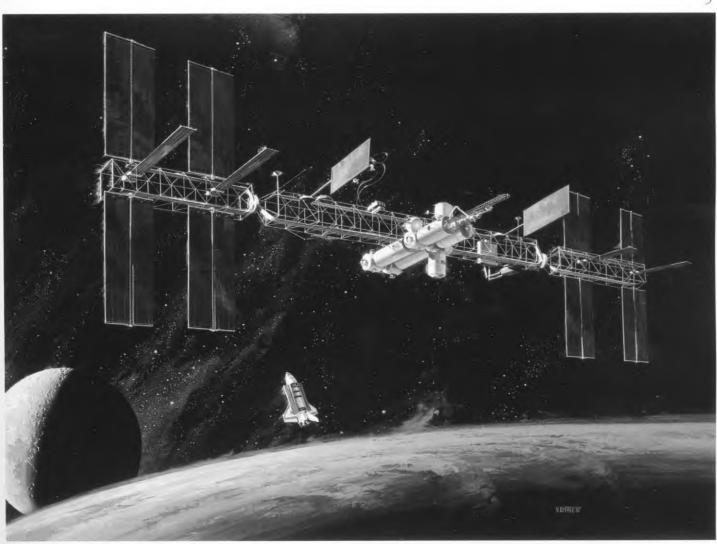
- 1) Hundreds of GE Camden employees penned their support to US troops in Saudi Arabia during Operation Desert Shield on a larger-than-life greeting card in September 1990. This gesture of moral support was received by the troops just prior to the start of Operation Desert Storm, where GCSD-supplied equipment contributed to the rapid victory in 1991.
- 2) Denyse Le Fever, International Business Development Manager at GE GCSD, is taking the talented personnel and quality products of the Camden-based business beyond domestic boundaries and winning new programs in the 1990's global marketplace.
- 3) Jim Fayer, Programs General Manager for GE GCSD's Information Processing Systems (IPS) group (holding plaque, left) presenting the group's Recognition Award to Jim Aker (holding plaque, right) and the IPS Data Group (l-r): Angelo Capaldi, Frank Mannella, Althea Hafeeza, Linda Facciolini, Anna Drusdow, and Nelson Peterson for outstanding performance in supporting proposal developments which led to winning programs in 1990.







- 4) GE Camden continued to enhance its position as a leading supplier of tactical, portable microwave communications to the US Department of Defense when it won a competitive program in 1991 to develop a next-generation, man-portable satellite ground station.
- 5) Continuing its legacy in communications pioneering for NASA and the US Space Program, GE GCSD was awarded a major contract on December 1, 1987 and is currently developing the communications and tracking subsystem for Space Station Freedom as a subcontractor to McDonnell Douglas Astronautics Company. GE Astro-Space Division also received a NASA award to build a free-flying, unmanned platform to circle the earth and carry scientific instruments for Space Station Freedom. Courtesy: NASA.

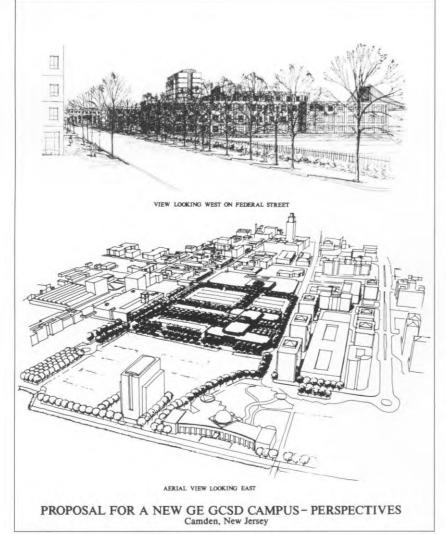




1) March 19, 1991 will be remembered as a day when private industry, government and labor worked together in the spirit of innovation and change. A historic press conference was held in the Building #2-1 auditorium of GE GCSD, Camden, NI for the signing of a tentative agreement between GE, local Camden agencies and the State of New Jersey for construction of new facilities for GE Camden. Governor Jim Florio (far right) watched as General Manager Bill Gingrich signed the agreement on the desk of Eldridge R. Johnson, founder of the Victor Talking Machine Company and the original Camden plant. Others who signed the historic agreement were (l-r): Joan Davis, Camden Redevelopment Agency, Anthony Coscia, NI Economic Development Authority and Mike Di Piero, Camden County Freeholder Director.

2) Artist's renditions of the future site of GE GCSD in Camden, NJ, looking west on Federal Street (top) and looking east from over the Delaware River, showing the "I" shaped complex surrounded by trees which extend to the property boundaries on Delaware Avenue (foreground), Market Street (left), N. 3rd Street (background) and Federal Street (right). The new GE complex will be adjacent to the future waterfront addition of the world headquarters of Campbell Soup Company (left foreground) and the NJ State Aquarium (right foreground). GE Camden's new facilities will consist of a 350,000 -square-foot engineering/administration building and a 225,000-square-foot final assembly and test building. Consolidation from the current plant (Buildings #2, 3, 4, 8, 9/12, 10/13 and 17) is being driven by the need for modern, cost-efficient facilities, which will make GCSD more competitive in the tough defense market of the 1990's.

3) Aerial view, looking north, of the \$42 million NJ State Aquarium, under construction on the Camden waterfront and the current GE Camden plant in the background (beyond the huge parking lot), in May 1991. The new GE complex will be located on the site occupied by the blackroofed warehouse buildings of Campbell Soup Company (in front of the Nipper Tower and Building #17).





It seems appropriate that, in 1991—the year which marked the 90th anniversary of the Camden plant-an agreement was signed between GE, the City and County of Camden, and the State of New Jersey for the development of new facilities for GE in Camden. These new facilities, to be constructed on a site formerly occupied by the Campbell Soup Company on Market Street, between Delaware Avenue and North 3rd Street, are scheduled for completion in 1993. The new GE Camden facilities will overlook a newly-revitalized Camden waterfront, which will include the upcoming, ultra-modern \$42 million New Jersey State Aquarium (opening in 1992) and the new world headquarters building of the Campbell Soup Company. And across Market Street, north of the new GE Camden complex, will remain the world-famous symbol of quality high atop the historic tower of Building #17-the stained-glass rendition of "His Master's Voice"- shining brightly by day and night as a lasting reminder of nearly a century of communications pioneering by the Victor Talking Machine Company, Radio Corporation of America and General Electric Company in Camden, New Jersey.



4) Cooper's Ferry Development Association, Inc. (CFDA), a private, non-profit organization, was created in 1984 to promote and coordinate the private and public investment decisions necessary to develop the 90-acre Camden waterfront. (Cooper's Ferry was the name of the Camden waterfront section before the City was incorporated in 1848.) Included in the CFDA's waterfront revitalization plan is a restart of ferry service between Penn's Landing, Philadelphia (shown here at left) and the Camden waterfront, to stimulate tourism. The last Philadelphia-Camden ferry service was discontinued on March 31, 1952. Courtesy: CFDA.

Bibliography

The following sources are listed by order of use as references for this publication. GE expresses its sincere gratitude to all authors for their valuable contributions.

Bayly, Ernie. The Story of "Nipper" and the "His Master's Voice Trademark. 2nd ed. Bournemouth, England: The Talking Machine Review, 1983.

Edge, Ruth and Leonard Petts. A Guide to Collecting His Master's Voice "Nipper" Souvenirs. Hayes, Middlesex, England: EMI Music Archives, 1984.

Dyer, F.L., T.C. Martin and W.H. Meadowcroft. Edison: His Life and Inventions, Volume 1. New York: Harper Brothers, 1929, p. 207.

Johnson, E.R. Fenimore. *His Master's Voice was Eldridge R. Johnson*. 2nd ed. Milford, Delaware: E.R. Fenimore Johnson and State Media, Inc., 1974.

Aldridge, B.L. The Victor Talking Machine Company. New York: RCA Sales Corporation, 1964.

Fagan, Ted and William R. Moran. The Encyclopedic Discography of Victor Recordings. Westport, CN: Greenwood Press, 1983.

Bolig, John Richard. *The Recordings of Enrico Caruso*. Dover DE: Eldridge Reeves Johnson Memorial of the Delaware State Museum, 1973.

Baumbach, Robert W. Look for the Dog: An Illustrated Guide to Victor Talking Machines. 4th ed. Woodland Hills, CA: Stationery X-Press, 1990.

The Voice of the Victor. Camden, NJ: The Victor Talking Machine Company, 1906-1930, Various issues, Volumes I-XXIV.

Sherman, Michael W. The Paper Dog; An Illustrated Guide to 78 R.P.M. Victor Record Labels 1900-1958. A.P.M. Press, 1987.

Ballinger & Perrot, Architects. "Cabinet Factory, Victor Talking Machine Company, Camden, NJ." *American Architect*, 1917, pp. 109-118.

Walter T. Karcher & Livingston Smith, Architects, "Home Office Building, Victor Talking Machine Company." *American Architect*, Vol. CXI, No. 2153, 28 March 1917, pp. 194-205.

The Radio Corporation of America. The 50-Year Story of RCA Victor Records. New York: RCA Department of Information, 1953.

Whitburn, Joel. Joel Whitburn's Pop Memories: 1890-1954. Menomonee Falls, WI: Record Research Inc.

"Victor Talking Machine History is Real Business Romance" Centennial Mirror of City of Camden, 1928.

Sooy, Raymond. Memoirs of My Recording and Traveling Experiences for the Victor Talking Machine Company, circa 1931.

Hutto, Ed. "Slide Presentation on Eldridge Johnson and the Victor Talking Machine Company." RCA Corporation, Camden, NJ, 1975.

Kolodin, Irving. "Edison's Baby: From Tinfoil to Tape." SR, July 23, 1977, pp. 20-22.

Hack, Richard. "Celebrating 100 years of Recorded Sound." The Hollywood Reporter, December 15, 1977, pp. 6-8.

"100 Years of Sound Reproduction." High Fidelity, January 1977.

Hope, Adrian. "A Century of Recorded Sound." New Scientist, 22-29 December 1977, pp 797-799.

The Ballinger Company. The Ballinger Company: Architects and Engineers. Philadelphia: Ballinger, 1943.

RCA Corporation. RCA: A Historical Perspective. 7th ed. Princeton: RCA Technical Excellence Center, 1985.

The Ex-RCA'ers Lunch Club: Background History and Directory. New Jersey: The Ex-RCA'ers Lunch Club, September 1990.

RCA: The Years 1930-1978 in Selected Articles from Fortune. New York: The RCA Corporation, 1979.

Anderson, John M. "Supplying Tubes, Sets and People to RCA; The General Electric Connection." The AWA Review, Vol. 5, 1990.

The RCA Family Circle. New York: Department of Information, Radio Corporation of America, Vol. I, 1935, Vol. II, 1936 and Vol. V, 1939.

"Radio Moving Day." Westinghouse Magazine, Vol. 4, No. 2, February 1930.

Radio Apparatus for Amateur and Experimental Use. New York: Radio Corporation of America, Sales Division, 1921.

RCA Colortrak: The Story of Innovative Technology in Television. Indianapolis: RCA Consumer Electronics Division, News and Information Department, 1977.

RCA Victor Company, Inc. RCA Victor Service Notes for 1929-1930. Camden: Service Division, RCA Victor Company, Inc., 1930.

Broadcast News. Camden: RCA Victor Company, Inc., No. 1, October 1931.

Radio Age. New York: Department of Information, Radio Corporation of America, Vols. 8 and 9, 1941-1949.

Electronic Age. New York: Radio Corporation of America, Vols. 17-23, 1958-1964.

RCA Laboratories. 1942-1967: Twenty-Five Years at RCA Laboratories. Princeton: RCA Laboratories, 1968.

Lyons, Eugene. David Sarnoff. New York: Harper & Row, 1966.

Whitmore, F.D. "RCA Engineering-The First Twenty Years." RCA Engineer, Vol. 14, No. 1, pp. 3-10.

Kaufman, Samuel, "NBC's 40th Anniversary; Electronic Age, Vol. 25, No. 3, Summer 1966, pp. 6-11.

Brown, George H. and part of which I was. Princeton: Angus Cupar Publishers, 1953.

33 Years of Pioneering and Progress. Department of Information, Radio Corporation of America. New York: Radio Corporation of America, 1953.

RCA: What It Is... What It Does. Department of Information, Radio Corporation of America. New York: Radio Corporation of America, 1949, 1952, 1956.

The Story of Television. New York: The Radio Corporation of America, 1951.

RCA: Ten Years of Progress (1946-1956). Department of Information, Radio Corporation of America. New York: The Radio Corporation of America, 1956.

Miller, John Anderson. Workshop of Engineers: The Story of the General Engineering Laboratory of the General Electric Company, 1895-1952. Schenectady: The Maqua Company, 1953.

White, W.C. "Early History of Electronics in General Electric." Diss. Hall of History, Schenectady, NY, 1954.

Sarnoff, David, "The Birth of an Industry." RCA Review, Vol. IV, No. 1, July 1939, pp. 3-5.

The Radio Corporation of America. *Pathfinding in Radio: The Story of RCA Research and Development*. New York: Department of Information, Radio Corporation of America, January 1947.

Cranston, Paul F. Camden County: Two Hundred and Fiftieth Anniversary, 1681-1931. Camden: Camden County Chamber of Commerce, 1931.

Keller, David Neal. Stone & Webster, 1889-1989: A Century of Integrity and Service. New York: Stone & Webster Incorporated, 1989.

Radio Corporation of America. RCA News, Vol. XI, July 1930.

RCA Institute Technical Press. RCA Review, Vol. I, No. I, July 1936 and Vol. IV, No. 1, July 1939.

May We Introduce You to Some of the People. New York: The Radio Corporation of America, 1940.

Radio Service News. Camden: RCA Manufacturing Company, Inc, Vol. 2, No. 2, November 1935 and Vol. 5, No. 1, June 1939.

Television: A New Horizon by RCA Victor. Camden: RCA Manufacturing Company, Inc., 1939.

The Scanner. Camden: Engineering Department, RCA Victor Division, RCA Manufacturing Company, Inc., Vol. 1, 1936 through Vol. 7, 1942.

Inglis, Andrew F. Behind the Tube: A History of Broadcasting Technology and Business. Boston: Focal Press, 1990.

RCA Engineer's Digest. Camden, NJ: Engineering Products Department, RCA Victor Division, March-April, July and November-December 1952.

To The Peoples Commissariat of Electrical Industry from Radio Corporation of America. New York: Radio Corporation of America, 1944.

The Bizmac Story. Camden: RCA Commercial Electronic Products, 1956.

You and RCA: Hourly Employees' Handbook. New York: Radio Corporation of America, 1957, 1965.

RCA Report to Employees. New York: Radio Corporation of America, 1949, 1950, 1951.

RCA Annual Report. New York: Radio Corporation of America, Various, 1921-1968.

RCA Annual Report. New York: RCA Corporation, 1969-1985.

Broadcast Audio Equipment for AM, FM, Television. Camden: Broadcast Equipment Section, Engineering Products Department, Radio Corporation of America, March 1954.

Everything in Broadcast Microphones, Loudspeakers and Complete Accessories. Camden: Broadcast and Televison Equipment Division, Radio Corporation of America, November 1, 1952.

RCA Victor Family News (Camden Edition). Camden: RCA Victor Division, Radio Corporation of America, Vol. 8, 1950 through Vol. 12, 1954.

RCA Family News (Camden Edition). Camden: Radio Corporation of America, Vol. 12, 1954 through Vol. 13, 1955.

RCA Family, Camden NJ. Camden: Radio Corporation of America, Various issues, 1956-1986.

RCA Space Programs. Cherry Hill: RCA News and Information. RCA Corporation, June 1979.

Backgrounder: RCA Aerospace and Defense. Cherry Hill: RCA News and Information, RCA Corporation, May 1985.

RCA Trend. Princeton: RCA Technical Excellence Center, RCA Corporation, Vols. 24-26, 1984-1986.

General Electric Company Annual Report. Fairfield: General Electric Company, 1985-1990.

Welch, John F. Jr. "Speed, Simplicity, and Self-Confidence: Keys to Leading in the '90's." The General Electric Annual Meeting of Share Owners, Greenville, SC, April 26, 1989.

In Touch. Camden: GE Government Communications Systems Department, Vol. 1, July 1989 through Vol. 3, August 1991.